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WHAT CONGRESS DID

And How It May Be Expected to Affect the Metal-Working Industry

K. H. CONDIT
Editor

FROM THE PRESIDENT'S BROADCAST OF JUNE 28

AS WE review the achievements of this session of the 73rd Congress, it is made increasingly clear that its task was essentially that of completing and fortifying the work it had begun in March, 1933. That was no easy task, but the Congress was equal to it.

It has been well said that while there were a few exceptions, this Congress displayed a greater freedom from mere partisanship than any other peace-time Congress since the administration of President Washington himself. The session was distinguished by the extent and variety of legislation enacted, and by the intelligence and good will in debate upon these measures.

I mention only a few of the major enactments. It provided for the readjustment of the debt burden through the corporate and municipal bankruptcy act and the farm relief act. It lent a hand to industry by encouraging loans to salvage industries unable to secure adequate help from banking institutions. It strengthened the integrity of finance through the regulation of securities exchanges.

It provided a rational method of increasing our volume of foreign trade through reciprocal trading agreements. It strengthened our naval forces to conform with the intentions and permissions of existing treaty rights. It made further advances toward peace in industry through the labor adjustment act. It supplemented our agricultural policies through measures widely demanded by farmers themselves, and intended to avert price destroying surpluses.

It strengthened the hand of the federal government in its attempt to suppress gangster crime. It took definite steps toward a national housing program through an act which I signed today designed to encourage private capital in the rebuilding of the homes of the nation. It created a permanent federal body for the just regulation of all forms of communication, including the telephone, the telegraph and the radio.

Finally, and I believe most important, it reorganized, simplified and made more fair and just our monetary system, setting up standards and policies adequate to meet the necessities of modern economic life, doing justice to both gold and silver as the metal bases behind the currency of the United States.

SINCE all the measures of primary importance enacted by the Congress that has just ended were administration measures, and since these measures were passed in essentially the form advocated by the administration, the least the President could do was to commend Congress on its record. In view of the enormous Democratic majority in both houses, it is not so surprising that this Congress displayed freedom from mere partisanship. There have been some unkind enough to call it a rubber-stamp Congress. On the whole, however, its record of constructive action far outweighs the destructive or obstructive actions, such as the over-riding of the pension bill veto.

Industry might have fared better at its hands, but on the other hand it might have fared far worse. Now that the various measures have become law it should be worth while to study them to see what their effect on the metal-working industry may be.

Since it is now generally conceded by intelligent people that the main cause of the depression was not the over-development of our manufacturing industry, but rather a break-down of our financial facilities, the actions of Congress to improve the financial structure of the country merit first consideration.

Information gathered by the Federal Reserve Board indicates that there are many companies in the United States in need of working capital. There has been some tendency to discount the return from the Reserve Board's questionnaire on the ground that it would be natural for the average business man or industrialist to reply that he is unable to obtain adequate credit through customary channels. More than that, it has been argued that many responsible producers are not going to borrow money to produce goods until they have definite assurance that the goods can be sold at a profit. Under present conditions it is difficult to secure such assurance.

But at the Reconstruction Finance Corporation offices, where most of the direct loans to industry will be handled, there is confidence that many such loans will be made. This belief is based on thousands of letters that have been received, and upon the knowledge that surpluses have been absorbed in a great many lines.

None of us will have forgotten the desperate effort made by the banks during the period preceding the bank holiday to collect the maximum possible amount on an outstanding loan in order to become liquid. To meet the demands of the banks borrowers during that period disposed of all saleable assets and as a result they are now in a position where they no longer have the type of collateral demanded by the banks. Many of them are in a position, however, to qualify for loans under the new act.

Having gone through a storm of criticism because of their failure to act more promptly on applications for self-liquidating loans, it is believed that the R.F.C. officials will insist upon the rapid handling of the applications received. Steps are being taken to revise certain phases of the present regulations so as to make eligible a larger proportion of these applications.

Restrictions on Loans

The restrictions indeed are stringent enough—so stringent, probably, that few applicants who are unable to get loans from their own banks will have much better success with R.F.C. The limitations imposed by law as listed in circular No. 13 of the Reconstruction Finance Corporation, dated June, 1934, are these:

(a) The applicant must have been established in business prior to January, 1934.

(b) Adequate security must be provided.

(c) The maturity of the loan must not exceed five years.

(d) The applicant must be solvent at the time of disbursement of the loan.

(e) Credits at prevailing bank rates for loans of the character applied for must be not otherwise available at banks.

(f) Such loans may be made only when deemed to offer reasonable assurance of continued or increased employment of labor.

(g) The aggregate of such loans to any one applicant, or the participation of Reconstruction Finance Corporation therein, shall not exceed $500,000.

(h) Such other terms, conditions, and restrictions as Reconstruction Finance Corporation may determine.

Interest and Repayment

Before any loan is made a program of payment will be drawn up. The interest is to be at the prevailing bank rate. Loans may not be used for financing consumer purchases or installment sales. They may not be used to finance exports or imports. They are not to be used for development and promotional purposes, or for expansion into new fields of endeavor. They will not be made unless economic need for the product is shown. No loan will be made to a concern which has not been in operation for a substantial period.

No loan will be made for the operation of a business if it is in the hands of a receiver, but applications will be considered for loans that will terminate a receivership and allow the business to be restored to a solvent condition. In fact, officials of the Corporation think that great benefit will follow the offering of loans contingent upon the scaling down of existing debts. Ordinarily, loans will not be made for the purpose of paying off existing indebtedness, although when a plan of reorganization has been agreed to by existing creditors, relatively small payments on account will be allowed. In like fashion, incidental payments of taxes will be allowed.

The principal purpose of these loans will be to supply working capital, such as for the payment of labor and the purchase of material. No loans will be made to supply fixed capital. Exceptions will be made, however, when replacements of machinery or equipment are essential to effective operation, but such expenditures must not exceed a "small portion" of the entire loan. Under exceptional circumstances, loans will be made to contractors to supply working capital, provided satisfactory arrangements have been made for the financing of the entire cost of the project which the contractors are undertaking to construct.

Where the stimulation of one concern will have a material effect on a competitor, the competitor will be given an opportunity to be heard as to the economic need for increased production in his particular line.

The provision of the law requiring that all loans be adequately secured is interpreted as requiring a first mortgage on real estate, plant and equipment, a first mortgage on chattels, an assignment of current accounts, trade acceptances or notes receivable, warehouse receipts on merchandise stored, or a first mortgage on other assets acceptable to the R.F.C. Second mortgages usually will not be considered as satisfactory primary security. Parts of bond isues will not be accepted unless the bond has a readily ascertainable market value. The same applies to shares of stock, franchises, patents and foreign securities.

Complete compliance with an NRA Code, or the President's reemployment agreement, is an iron-clad prerequisite for any loan. No applicant may pay a bonus commission or fees for the securing of a loan. So long as any portion of a loan remains unpaid, the R.F.C. will be allowed to pass upon the reasonableness of all salaries. No dividends may be paid or distributions to partners made without the consent of the R.F.C.

The R.F.C. emphasizes its willingness to cooperate with banks or other lending institutions, should they desire to have the corporation participate in the risk; this refers particularly to large loans.

No application will be received primarily at the Washington office of the corporation. Applications must be made from the regional loan agencies of the R.F.C.

Federal Reserve Regulations

The Federal Reserve Banks are still working on the regulations under which they will make direct loans. Because of the many responsibilities involved, there has been a decided upturn in the consumption of midnight oil in the offices of those engaged in drafting these regulations.

Officials in Washington recognize that responsible persons are not going to apply for loans to undertake production in lines where there are existing surpluses, but they point out that surpluses of many manufactured commodities already have been used up and with other surpluses are melting away rapidly. They believe one of the benefits of the direct loan act is that it will stimulate banks to loan. It also is expected to stimulate the private lender whose refusal to buy commercial securities has left many industries without working capital.

From the tone of these regulations it is perfectly clear that builders of machine tools and other production equipment may expect little stimulation of their business through loans to customers. Capital goods are too carefully ruled out. They may profit, of course, through the privilege of securing such loans, if they themselves are in need of working capital. The need still exists for some type of intermediate credit bank to finance equipment purchases over periods running into several years.

Stock Exchange Control

The New Stock Exchange Control Act, with its provisions amending the Securities Act of 1933, while it seems more remote from industry than the Loans to Industry Act, may well be productive of more good, because of its possible stimulation of the private capital market. In Washington this bill is regarded as constructive legislation, moderate rather than extreme in its terms. It is considered to be a highly successful attack on the very citadel of entrenched finance.

The bill as originally introduced was drafted by radicals with axes to grind, but Congress thoroughly revised the measure and eliminated most of the long-haired features. In its final form this legislation is looked on as a measure calculated to foster the useful functions of the market and to regulate its harmful features.

There is now a very general agreement that it is wise for the margins to go to the Federal Reserve Board. This now becomes the most important means of credit control. It is exercised by an agency that approaches the problem from the standpoint of volume of credit and volume of speculation, and not with the idea of trying to catch malefactors, or from the standpoint of the safety of the security. The matter of safety can be left to the lenders, and the malefactors can be left to the commission and to the district attorney. From the point of view of the machinery end of the metal-working industry, a free market for private capital is essential to existence. No other way has yet been found to finance the large scale operations involved in the production of capital goods. The Loans to Industry Act with its five hundred and eighty millions of dollars to lend can obviously care for only a minor fraction of the normal needs of the capital goods industry. Insofar as the Stock Exchange Control Act and its amendments to the Securities Act stimulate and steady this market, they will be of advantage to the metal-working industry.

The Corporate Bankruptcy Act signed by the President on June 7 is likely to be of assistance to the metal-working industry in certain instances. It is intended to ease debt deflation and prevent a minority of the creditors of the bankrupt organization from blocking a reasonable adjustment, which is satisfactory to the majority of the creditors. How useful this legislation may be is indicated by the promptness with which briefs were filed by large companies just as soon as the bill had been signed.

Of equal importance to industry are the bills dealing with the labor question. Here, both Congress and the President came very close to letting their enthusiasm for reform outweigh their recognition of the need for recovery. Almost without exception the employers of labor were convinced that passage of the Wagner bill spelled the end of recovery. Possibly they took it too seriously, but the fact that they felt as they did would certainly have resulted in a serious slowing down of activity.

Fortunately the Wagner Bill did not pass. In the closing days of the session a compromise measure was put through and it is with this that industry must now deal. The new law provides that the President may name a board or boards to handle labor disputes. A precedent for naming a board to deal with a particular situation exists in the establishment of the board for the automobile industry under the chairmanship of Leo Wolman. On this board the chairman is neutral; one member represents labor and one the employers. The precedent was not followed in the establishment of the National Steel Labor Board. In this case all three members represent a disinterested point of view.

A New Labor Board

One of the last moves the President made before leaving on his long vacation was the appointment of an impartial labor board which replaces the Wagner Board and takes the handling of labor disputes away from the NRA. The three members of this board—Lloyd Garrison, chairman and head of the University of Wisconsin Law School; H. A. Millis, University of Chicago economist, and vice-chairman of the Chicago Regional Labor Board; and E. S. Smith, Massachusetts Labor Commissioner—are apparently impartial in their point of view and experienced in the type of work that will be required of them. This board is nominally an adjunct of the Department of Labor and reports to the President through the Secretary of Labor, but its decisions will not be subject to review by the Department.

This board, or any regional or industry board that it may set up, may study conditions and order elections to select "representatives of their own choosing," for employees in various industries or plants, but it cannot force the employers to accept these labor groups or even to bargain collectively. It can decide, however, whether a majority rules in selecting the employee representative, or whether there shall be proportionate representation as in the automobile industry and in most works councils. It has not the power, however, to enforce this ruling on the workers and make them follow the decisions that the representatives and the employers may reach. Much seems to be left to the decisions that will have to be made by the Board and by Secretary Perkins. Consequently, what they do this summer should be watched very carefully by industries everywhere. If they can arrive at some means of heading off the strikes that are now being planned and that will be pulled as soon as business picks up sufficiently, they will more than justify the hope which the President has placed in them.

Old Age Pensions

Another bit of last minute legislation, not on the administration list, was the Railway Retirement Act, under the terms of which at least 100,000 railroad employees will be placed on the pension list this year. The cost to the railroads is variously estimated, but it seems reasonable to believe that the addition to the annual pension bill will be of the order of $25,000,000. This piece of legislation is important to the metal working industry because it is indicative of the sort of pension legislation that may be expected by all industry when the President presents his program to the next Congress. It represents a long step in social legislation.

Congress made no changes in the National Industrial Recovery Act, but the very fact that it did not do so resulted in one rather important change. Under the terms of the Act that provision of the law which authorized the President to establish a code for an industry, and license firms in that industry to do business under the code, expired at the end of one year, or on June 16, 1934. No move having been made to retain this clause, it is now a dead letter automatically. In view of the eagerness of the vast majority of industrialists to get under a code, the President may well have felt that this club was not needed. General Johnson has felt that way about it and has said so on several occasions.

The next great drive of the administration to expedite recovery will be made under the terms of the National Housing Act which the President has just signed. Under the direction of James E. Moffett, an executive of the

Standard Oil Company of California, $3,000,000,000 will be used in an effort to stimulate new private building in the domestic and industrial field, and a major campaign of modernization and repair financed on an amortizing loan basis. The inauguration of this drive represents the recognition on the part of the administration that no amount of money likely to be expended on government public works can be expected to make up more than a small fraction of the amount spent annually in normal times for private building construction.

The details of the housing act are highly technical and represent the work of experts in this field. They are of no particular importance to the metal-working industry. The results of the bill will be important, however, to those sections of the industry engaged in manufacturing builders' hardware, construction equipment, plumbing supplies, heating, lighting, ventilating and electrical equipment for industry and the home, and such construction equipment as may be used by the builders and contractors. Builders of production machinery will profit indirectly as their customers in the fields just mentioned become more active and reach the stage where they can replace some of their obsolete production machinery.

Of similar import is the Highway Act in that it should produce business for builders of equipment used in highway construction, and thereby increase the chances that these manufacturers will buy metal-working machinery.

Army and Navy Purchases of Equipment

Some direct purchases of metal-working equipment will come through bills appropriating money for the Army and Navy. The Vinson bill, in particular, provides as one item $2,700,000 for enlargement of the Naval Aircraft Factory at Philadelphia. Building of war ships of course is a major metal working operation and as fast as the ships authorized in the Vinson bill can be laid down orders will flow into the offices of suppliers of materials, parts, equipment and machinery for the vessels. Orders of moderate size for machinery and other production equipment will result from some of the provisions of the various appropriation bills. Since these bills are in the nature of routine, there is no reason to expand upon them further.

Air Mail

After the gorgeous mess into which Congress and the administration got themselves as a result of Postmaster General Farley's ill-considered cancellation of air mail contracts, the new air mail legislation looks like orderliness itself. The immediate effects of this legislation on the metal-working industry are probably of small moment, but the latest result of the legislation has been the lowering of air mail rates to six cents an ounce. When the time comes for volumes of rush correspondence on orders for machinery, the saving in postage may be an item. May that time come soon!

In the eyes of most observers, one of the great forward steps taken by this Congress was the passage of the Reciprocal Tariff Act which was signed by President Roosevelt on June 12. For the first time the President has available a weapon more potent than mere words to combat trade restrictions applied by a foreign country to any of our products. The chances are that this bill will not result in any very immediate increase in our foreign trade. It will, however, be of considerable assistance in preserving what we have left. It should also be helpful in relieving that most difficult of trade barriers to surmount—the import quota.

So far as our own industries are concerned, the chances are that only the high-cost marginal producers will suffer at all. It is likely that the Tariff Commission will be instructed to survey any industry which is protected by a tariff amounting to 100 per cent, or somewhere near that figure. If any industries are sacrificed for the good of the majority, the chances are that they will be few and relatively unimportant.

Our best information is that the Washington authorities would like to get all tariff rates down to a maximum of 50 per cent, except in the case of certain essential national defense items. It is also likely that there will be plenty of bargaining with free-list items. Negotiations along this line are now under way with Cuba and Colombia on a preference basis. Central Europe is likely to negotiate on agricultural products; the rest of the world on machinery and manufactured products.

Another important effect of this legislation will be on the exchange situation. Because of our large imports of coffee we are in a position to exert practical control of Brazilian exchange. Great Britain is in a similar position as regards Argentine exchange. Great Britain wants Brazilian exchange, and we want Argentine exchange. Obviously, there are the makings of a mutually satisfactory deal.

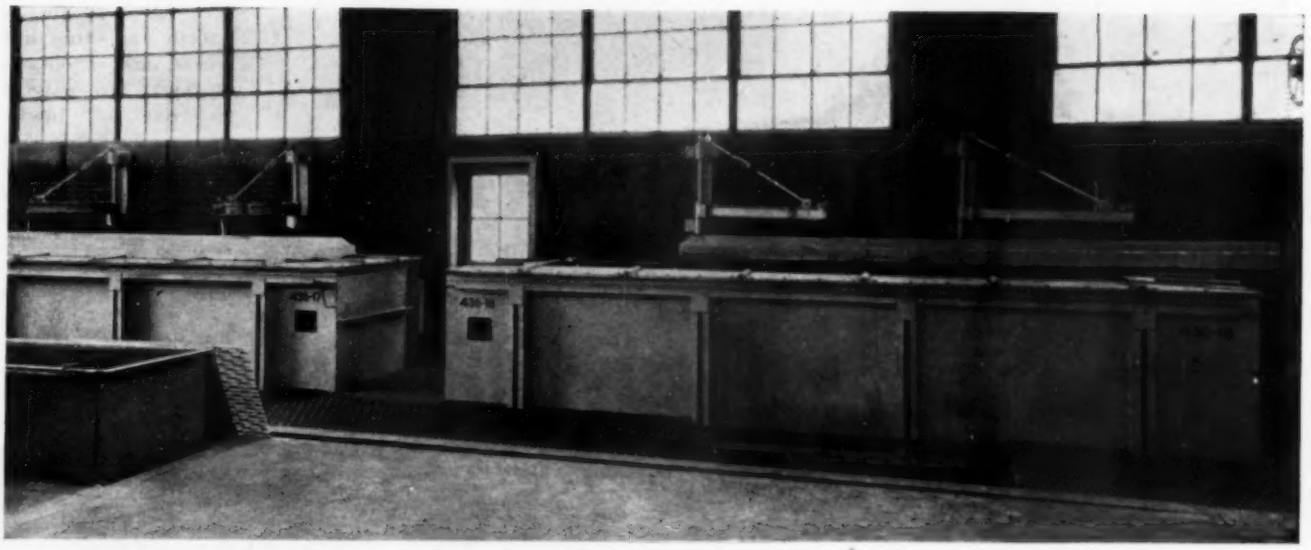
Another piece of legislation that bears on foreign trade is that authorizing the establishment of free ports where raw materials can be brought in duty free, manufactured, and re-exported. It is not clear that this will have any appreciable effect on the metal-working industry.

Constructive Acts Outweigh Destructive Ones

In conclusion I should like to say that I believe that much that was constructive came out of the last Congress, and that much that was destructive failed of passage. To that extent we should congratulate ourselves. On the other hand, many administrative rulings will be necessary before a lot of this legislation can be made to function effectively. Some of it is loosely drawn and will depend upon administrative interpretation. The metal-working industry should watch for these interpretations as they are announced. During the interval between the end of this Congress and the beginning of the next one, it should use every means to acquaint members of Congress with the needs of the industry, so that the accomplishments of the next congress may be as satisfactory.

Tool-Up Number

Activity in the toolrooms and tool and die shops usually peaks in August and carries on past the first of the year. This year promises to be no exception, and we are therefore scheduling a *Tool-Up Number* for August 29. All of the articles will deal with materials, methods, and equipment used in making jigs, fixtures and dies. Look for further details on specific articles in *American Machinist* for August 1.



Gas-heated salt baths have proved efficient for heat-treating duralumin at the Naval Aircraft Factory

Salt Baths for Dural

F. H. TREMBLY, JR.
Supervisor, Industrial Division
The Philadelphia Gas Works Company

IN THE heat-treating of duralumin airplane parts, there must be extremely precise control of temperature, and all parts must be heated uniformly. In the Naval Aircraft Factory at the League Island Navy Yard, Philadelphia, a bath of molten salt has been found to be the ideal medium for attaining these conditions. To melt the salt and maintain its temperature distribution accurately and uniformly a multitude of small flames are needed.

Prior to the erection of the two furnaces illustrated, a salt bath heated with oil burners had been used to treat duralumin. It had become increasingly apparent to officials of the aircraft factory that in order to improve the quality of product certain refinements in the heating operation were necessary, and the purchase of the two furnaces followed.

The pot width is roughly one-third the width of the furnace, measuring approximately 24 in. inside by 15 ft. in length. The contents of 48 in. deep tanks remains molten over night and week-ends by virtue of a small heat input provided by pilot burners. These pilots offset heat losses over the week-end so that it requires but one hour to bring either furnace up to the required temperature.

The furnaces are identical and were so designed in order that either may be used at high or low temperatures or that both temperatures might be available at the same time. Burners are arranged so that one-third, two-thirds or full capacity of gas input can be used, depending on whether the demand is light or heavy. Thus, an admirable grouping of burners has been obtained, with the main burner subject to temperature control and the pilots uncontrolled.

It will be noted that the burners and control valves are below the floor level. These valves are at the front of the furnace and the piping to the rear burners is carried below the heating chamber. Rarely is it necessary to remove the grates, although a walkway is provided which completely surrounds each furnace. The flues are readily adjustable to changes in the wind so that no excessive stack losses can take place.

The cover suspension is interesting in that in spite of considerable weight its handling is a matter of great simplicity. The small Z-shaped object appearing just above the furnace number is the jack-handle. This is thrust into the cover lifting jacks at the low point of the triangle to remove the cover from the pot. Having been raised clear of the pot, the whole arrangement is swung back toward the wall.

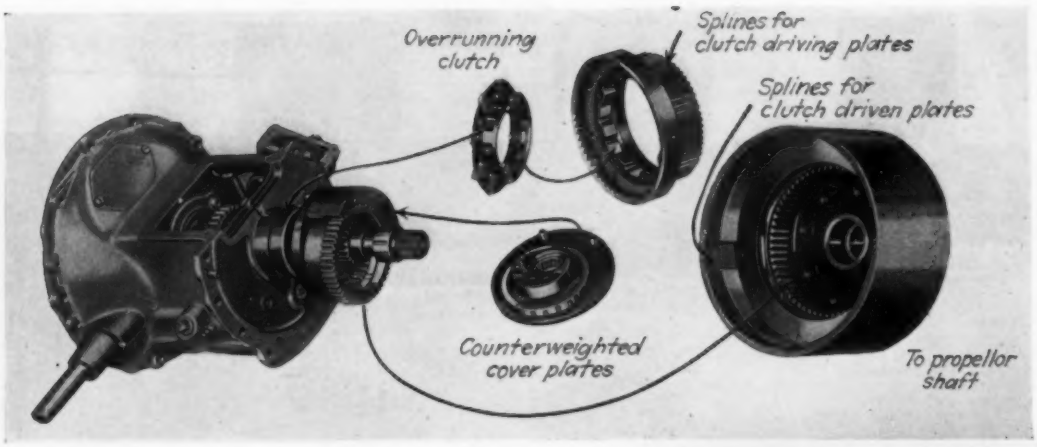
In the left foreground is partly shown a quenching tank used in some of the heat-treatments. Other treatments involve slower cooling.

The unusually clean appearance of the room and its equipment was not staged for the occasion. The operation of this equipment is such that it is easy to keep clean, there being no smoke, oily drippings or carbonization of parts.

An indication of the size of the furnaces may be had by comparison with the door at the rear of the shop which is of standard dimensions.

British Rail Cars Put Into Main Line Service

According to *Industrial Britain*, in July for the first time British rail cars are being put into regular main line service, by the introduction by the Great Western Railway Company of experimental super rail cars on its Birmingham-Gloucester-Newport-Cardiff route. Three cars have been built especially for this purpose. They have a maximum speed of 75 to 80 m.p.h. and provide morning and afternoon business service in each direction between Birmingham and Cardiff. They cover the distance of 117½ miles at an average speed of 56½ m.p.h. including stops at Gloucester and Newport.

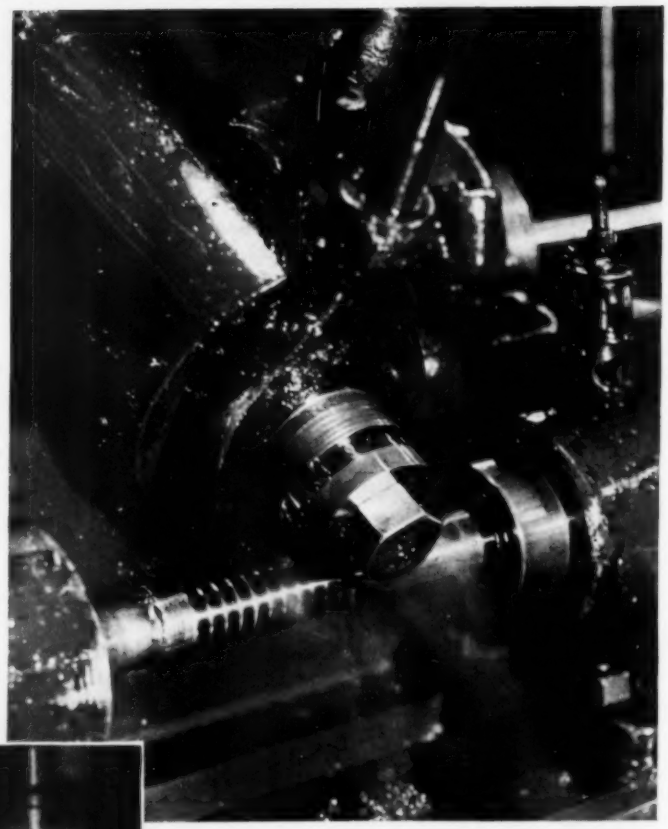


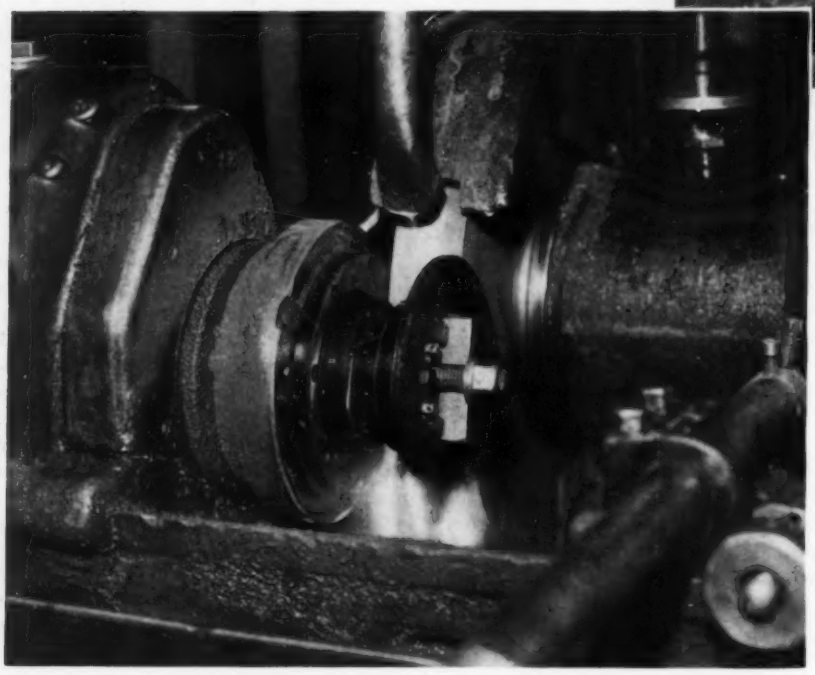
The lower of the two speeds on the automatic unit is obtained through two pairs of external and internal gears. Shifting to high speed or direct drive is effected through multiple-disk clutch engaged by a set of revolving weights

Self-Shifters in Process

R. A. DE VLIEG

In fulfilling the designers' dream of making the automatic transmission an actuality, Reo's production men met and solved some knotty shop problems



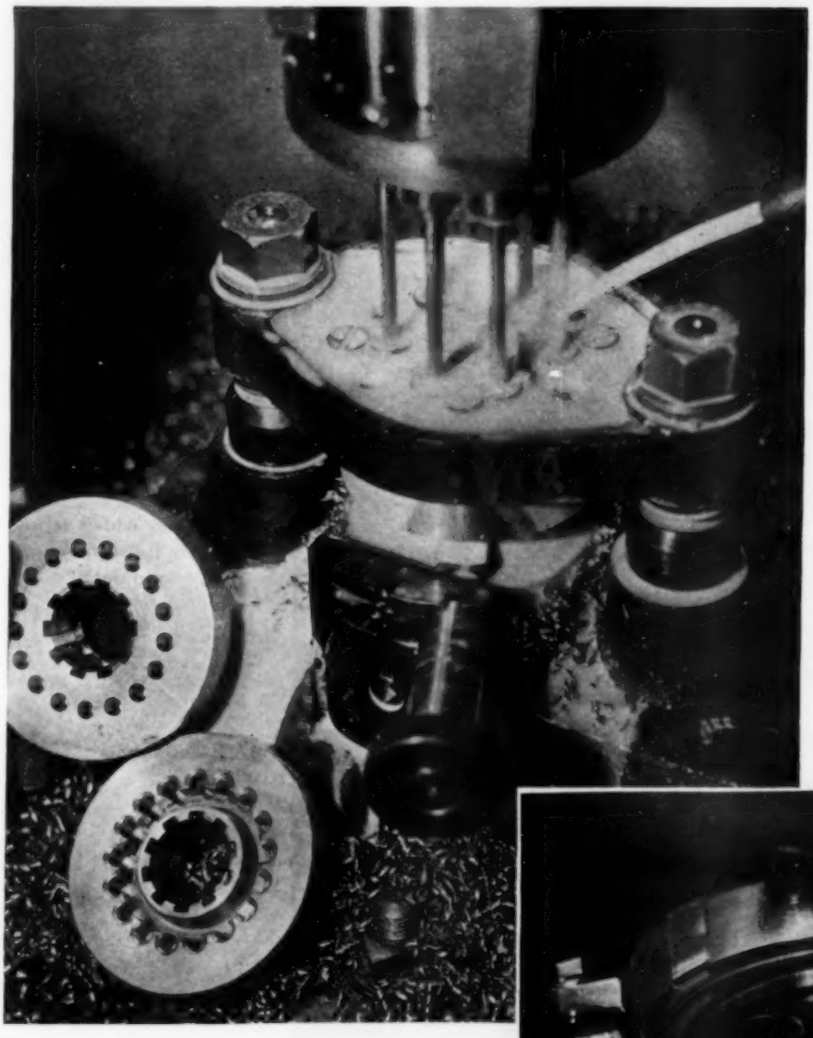


A circular rack transmits the movement of the selector to the gears. A form tool resembling a gear travels over the work and completes the rack teeth at a single pass

Ball race seats for the offset floating gears are ground in an eccentric fixture. By properly locating the work in the fixture the race seats are concentric with the spindle. Both seats are ground at once by using a broad-faced wheel

UNTIL the advent of the Reo transmission in 1933 none of the self-shifting devices for American motor cars survived experimental runs sufficiently well to be adopted as standard equipment. The design put into production by this manufacturer consists of two units, one automatic and one an auxiliary set of gears for selective control, emergency low speed and reverse. These are combined in a single case and mounted as a unit with the engine. Sliding selective gears are employed which revolve only when in actual use. Manufacturing these transmissions involves operations not met in other designs as the accompanying illustrations show.

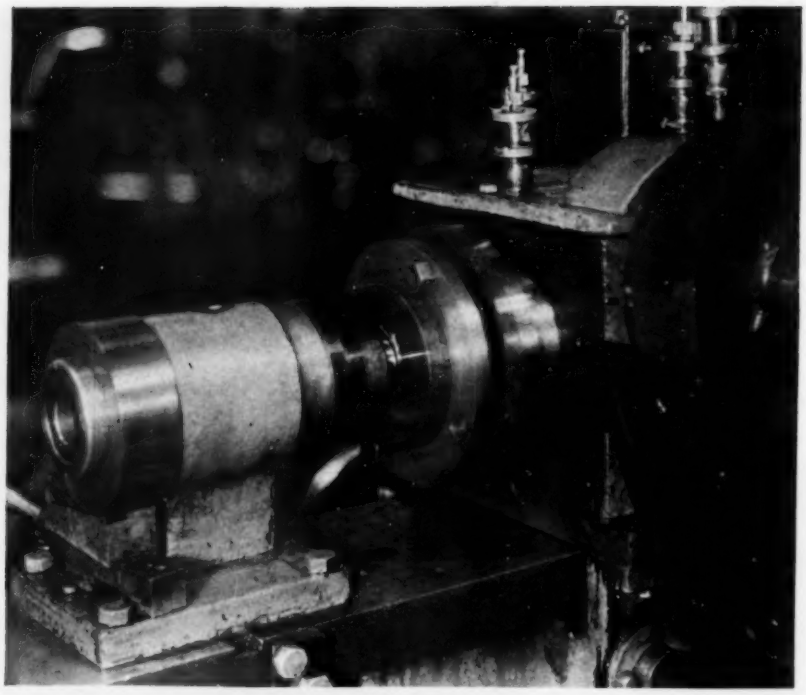
A gear shaper cuts the cam faces in the over-running clutch. The cutter revolves inside the work as in machining an internal gear, its special form giving the desired contour



Internal teeth in the control gear are first roughed out by drilling a series of holes with a multiple drill head. The fixture is indexed to drill seventeen holes with six spindles—in the last position one of the drills enters a hole already machined

Another gear-shaper job is cutting slots for the tongues on one set of the friction disks that form the clutch in the automatic unit. The clutch drum is clamped at four points

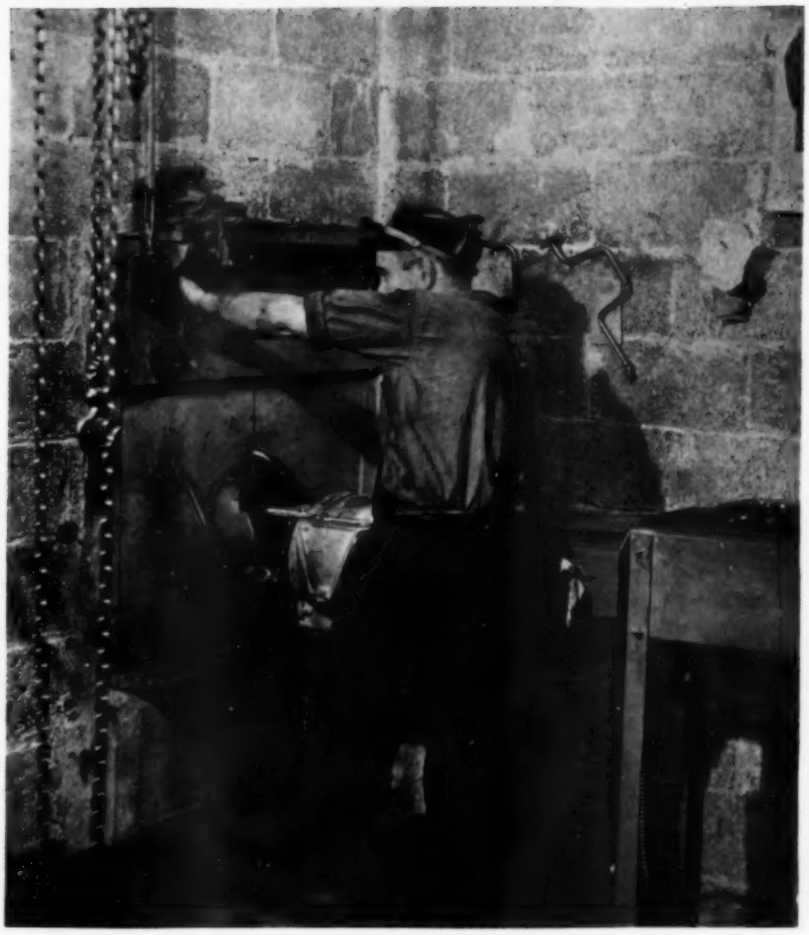
Internal gear sets are lapped in a special machine. The internal gear is reciprocated to give uniform lapping action while the external gear revolves inside of it. Sets are kept together for assembly in the same transmission to insure quiet action



Cam roller faces in the over-running clutch are finished with a form grinding wheel, belt driven. The wheel moves across the face of the cam which is indexed by its supporting spindle

After the clutch plates and internal gear have been assembled to the drum, the assembly is balanced statically on rollers. Compensation for unbalanced weight is made with a horizontal drilling machine

Automatic units may be seen in the rack behind the bench. From here they go to trucks, which roll on tracks, where they are assembled into the transmission cases



Completed transmissions are tested in a sound-proof room. Power is furnished by a Flying Cloud engine, which duplicates torque characteristics of the car. A dynamometer brake provides an adjustable load

Characteristics of Worm Gear Hobs—II

ROLAND V. HUTCHINSON

Continuing his analysis of cutter tooth contours, the author summarizes the practical application of his findings in the making of better tools

CONSIDERING axial relief alone, and neglecting motion due to tangential feed as of secondary importance, assume a unit angular velocity of the hob in *revolutions* per unit of time.

When any point in the gear cuts or touches the pitch planes, its velocity component parallel to the hob axis equals the lead of the hob. In Fig. 4, this is laid off as $Q'Q''$.

Corresponding axial components for all other points in the gear are proportional to the intercepts cut off by their projections on the pitch radius of the gear, extended if necessary. Hence the line OQ'' extended is the envelope of vectors representing such axial velocities.

On OW, the distances $Q'U$, $Q'V$ and $Q'W$, respectively, equal $2\pi\rho_R$, $2\pi\rho_x$, $2\pi\rho_t$, the root, pitch and tip circumferences of the hob, hence its tangential velocities at these radii, and the corresponding helix angles are $UQ''Q'$, $VQ''Q'$ and $WQ''Q'$, measured from the axis.

When cutting points on the hob lying upon these helices cut or touch the pitch plane, the direction of relative cutting is along them, and they are lines of local zero axial clearance for such conditions.

At beginning of their cutting, the full size finishing teeth tips with radius ρ_T, cut the blank at point T'''' desaxé from the centerline OW the distance $T'T''''$, set by the contact zone diagram plus Δf_{ae} (approximately). The axial velocity component of the gear at this point is $T'T'''$, that of the hob tip $Q'Q''$, and the latter is greater than the former in the ratio $OQ':OT'$; the velocities have the same direction and, since the hob is axially separating from the work, axial clearance is satisfactorily established while the hob is entering the blank. Having passed the center of the gear as the hob emerges, conditions reverse, and the gear tooth tends to interfere with the hob, for the latter is now behind, in contact with, and moving faster than the gear tooth, and should have a shorter lead for zero clearance. The relative direction of cutting for this condition is then established by projecting T'''' on $Q'Q''$ as T^{IV} and joining $T^{IV}W$, and the angular deviation from the direction of the top helix line is the angle $T^{IV}\,WQ''$.

The tangential feed effect is to change this angle a negligible amount.

Considering root conditions, the entering flank and gear tip move in the same direction, the gear tip faster than the hob and a maximum difference occurs at the centerline of the gear. The angular deviation is here Angle $Q''UM''''$. Shifting the hob endwise so that the trailing root lies on the centerline of the gear, clearance is once more established.

Hence axial relief specification is established for the trailing tip by the axial extent of the contact zone figure and for the entering root by center plane conditions, each slightly altered by the fact that tangential feed occurs.

Next, considering radial relief alone, in Fig. 5, let:

P be a point on both hob and gear, subscripted at times for convenience P_H and P_G without affecting the condition that P_H and P_G represent at all times one and the same point in space.

ρ_H be the radius of such point from the hob axis.

ζ be the angular position of P_H from the radial axial plane of the hob.

d_H be the desaxé of P_H from the radial axial plane of the hob.

d_G be the desaxé of P_G from the radial axial plane of the gear.

Assume unit angular velocity of the gear in *radians* per unit time in this instance.

The tangential velocity of P_G is P_GA, its axial component with respect to the hob axis, P_GB, and its normal component with respect to the latter, AB; whence

$$P_GA = \sqrt{(C - \rho_H \cos\zeta)^2 + d^2}$$
$$P_GB = C - \rho_H \cos\zeta$$
$$AB = d_G$$

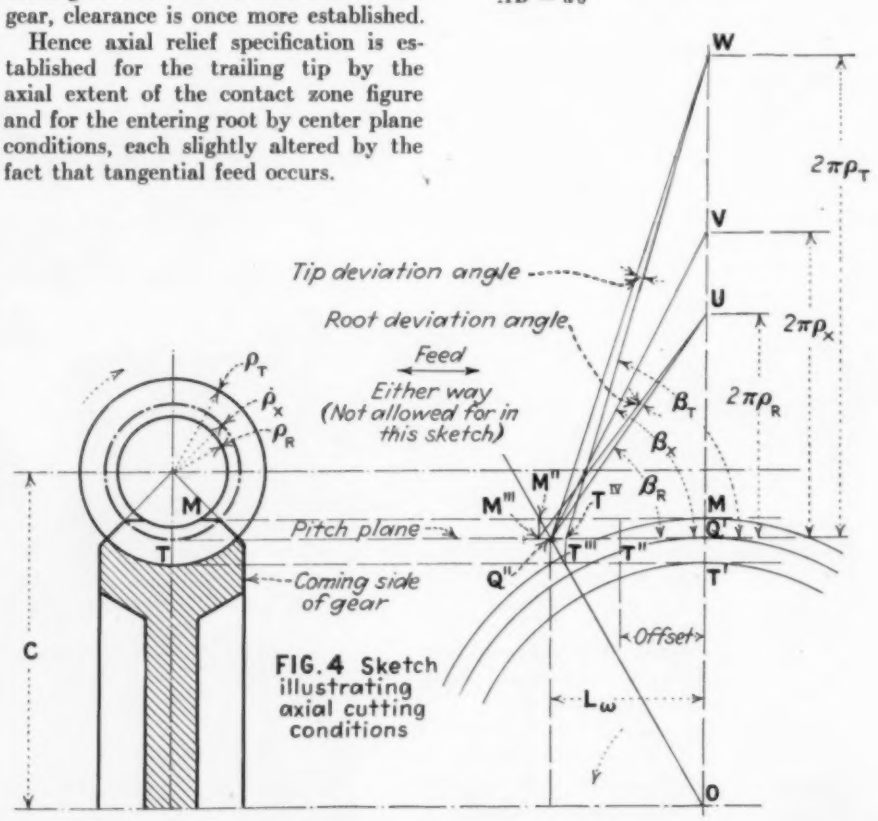


FIG. 4 Sketch illustrating axial cutting conditions

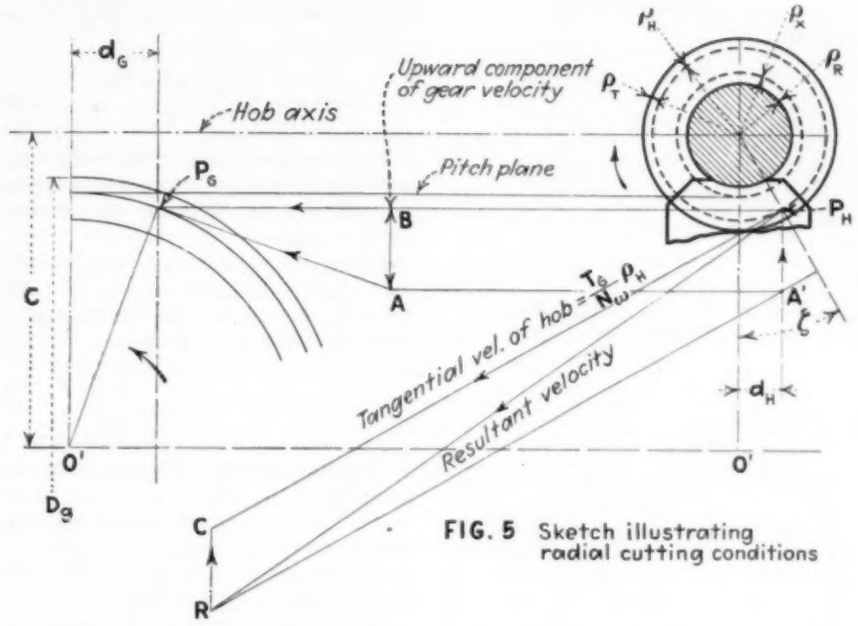


FIG. 5 Sketch illustrating radial cutting conditions

The latter relationship indicates that all gear points passing through a plane desaxé the amount d_G, have a vertical velocity component proportional to d_G and independent of their own radial distances from the wheel axis O'.

Project A *to* A' in the plane desaxé d_H from the hob, so that $AB = P_HA'$. From P_H draw P_HC tangent to the hob circle so that the length

$$P_HC = \frac{\text{teeth in gear}}{\text{threads in hob}} \times \rho_H = \frac{T_g}{N_w} \times \rho_H$$

Then for worst conditions in the normal transverse plane of the hob, namely, the hob teeth coming down meeting the gear teeth coming up, or vice versa, the relative directions of motion are along the line RP_H and the angle CP_HR is

$$CP_HR = \arctan\left(\frac{d_G \cos\zeta}{T_g/N_w \times \rho_H + d_G \sin\zeta}\right) \quad (21)$$

Expression 21 becomes maximum when $\zeta = 0$, and d_G a maximum. Also, as ρ_H diminishes, d_G approaches zero, so the maximum practical value occurs at an inclination to the tangent to the hob tip of

$$CP_HR_{max} = \arctan\frac{N_w\, d_G}{T_g\, \rho_T} \quad (22)$$

and the tip clearance must be radial relief with respect to this angle or direction.

Archimedian spiral relief increases inversely as the radius of the hob at the point of relief, and for any intermediate value of ρ, say ρ_H, the ratio ρ_T/ρ_H is greater than the ratio $C - \rho_R/C - \rho_T$; also the maximum d_G decreases with a decrease of ρ_R, whence satisfactory radial relief of the tips is accompanied by sufficient radial relief elsewhere on the hob.

Desaxé d_G is unchanged for both axial and radial considerations, and is set by contact zone diagram dimensions.

Reverting to the axial conditions for the moment, the decrement relief lead at the trailing tip will be $T^{IV}Q'' + 2\pi\rho_T \tan\gamma$, and for the leading root the increment relief lead will be $Q''M''' + 2\pi\rho_R \tan\gamma$, where γ is the clearance angle chosen.

The respective values of $T^{IV}Q''$ and $Q''M'''$ are

$$\left(\frac{C - \rho_T}{C - \rho_s} - 1\right) L_w \text{ and } \frac{D_s}{2(C - \rho_s)} \times L_w \text{ respectively}$$

where C = center distance

D_s = extreme diameter of gear

so that the superposed relief helicoids will have leads

$$-\left(\frac{\rho_T - \rho_s}{C - \rho_s} L_w + 2\pi\rho_T \tan\gamma\right)$$

decrement for trailing tip ..... (23)

and

$$\left(\frac{D_s}{2(C - \rho_s)} L_w + 2\Pi\rho_R \tan\gamma\right)$$

increment for entering root ..... (24)

The axial and radial relief components, in directions mutually perpendicular, furnish the direction of motion essential for their simultaneous existence as the result of using one and the same cutting point on the edge of the relieving tool.

The radial clearance angle required is

$$\arctan\frac{A_r}{\rho_T} = \arctan\frac{N_w\, d_G}{T_G\, \rho_T} + \gamma$$

Whence, eliminating the arctan notation, we have

$$A_r = \left(\frac{N_w d_G + T_G \rho_T \tan\gamma}{T_G \rho_T - N_w d_G \tan\gamma}\right)\rho_T \quad (25)$$

Expressions 23 and 24 are rarely numerically equal, and the angular setting of the relieving slide for oblique relief may be obtained as the angle whose tangent is A_r divided by the larger one of the two values 23 or 24, and a_c computed from it.

Calling the angle to which the relieving slide is set μ, and remembering that $A_r = \frac{N_R}{n_c} \times a_c \sin\mu$, we have, from Equation 25, the required value of the relieving cam constant as:

$$a_c \min = \frac{n_c}{N_R} \csc\mu \left(\frac{N_w d_G + T_G \rho_T \tan\gamma}{T_G \rho_T - N_w d_G \tan\gamma}\right)\rho_T \quad (26)$$

where n_c = number of lobes on the relieving cam.

With this relationship the side of the teeth corresponding to the rejected value of 23 or 24 is slightly over-relieved axially and radially.

If minimum relief on both sides is required, two a_c values develop, hence two cams are needed in this instance.

Shape of the Relieving Tool

The specification for the proper shape of relieving tool is that it shall pass through the intersection of the worm and hob tooth face helicoids.

In general no projection of the space-curve formed by such intersection is linear, so that if tools are to be made with their top surfaces plane, such tools are dissimilar in shape to that of the worm thread.

One exception to the above statement occurs when the gash is axial ($L_s = \infty$); another when the worm thread is screw-helicoidal and the tooth face helicoid simultaneously normal screw-helicoidal, in which case the tool edge is a straight line, if acting in the radial axial plane of the hob, though differing in slope from that of the radial axial section of the worm.

One method of meeting the situation is to fit the relieving tool, in the lathe, to a previously chased and gashed false worm. The tool is fitted light tight to the edge of these unrelieved teeth, which is the desired intersection, and in general does not have a cutting edge lying in a plane.

The complex flank shapes are hyperboloidal helicoids, and the hob cuts proper gears at only one of its many sizes during its life, if cutting and mounting dimensions are alike.

The exceptional screw helicoidal hob

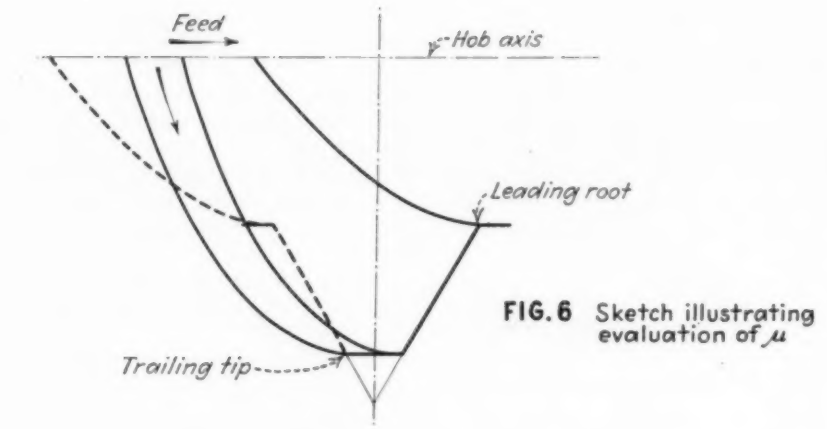
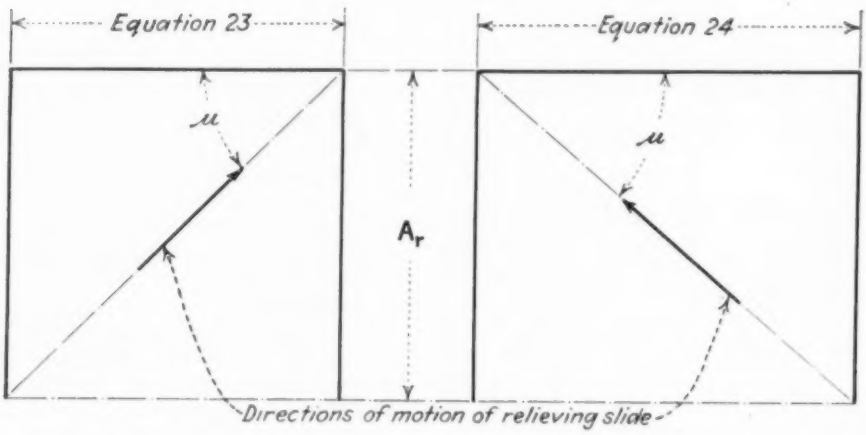


FIG. 6 Sketch illustrating evaluation of μ



may be properly relieved with a tool inclined to the axis by the angle

$$\alpha_t = \operatorname{arccot}\left[\left(1 \pm \frac{2\pi N_s a_c (\cos\mu + \sin\mu \cot\alpha_t)}{L_s n_c}\right) \cot\alpha\right] \quad (27)$$

which yields, using the positive sign,

$$\cot\alpha_{t+} = \frac{(L_s n_c + 2\pi N_s a_c \cos\mu)\cot\alpha}{L_s n_c - 2\pi N_s a_c \sin\mu \cot\alpha} \quad (28)$$

and, using the negative,

$$\cot\alpha_{t-} = \frac{(L_s n_c - 2\pi N_s a_c \cos\mu)\cot\alpha}{L_s n_c + 2\pi N_s a_c \sin\mu \cot\alpha} \quad (29)$$

The relieved flanks are screw-helicoids, and the above three equations are based on ability to produce Archimedian spiral relief with the relieving attachment. If the gashes are made to give rake to the teeth as described immediately following, the tooi edge is not a straight line, but for little rake may be so taken and relieving accomplished in a desaxé plane with little error accruing for small values of radial rake.

Choice of Gash Specification

Fig. 5 has shown the direction of cutting in the transverse planes, from which it is noticeable that hobs with radial faces cut, in effect, with variable top rake, in these planes.

Axial conditions delineated in Diagram 4, show any point on the flanks, whose tooth-face helix is normal to a line of zero axial clearance, cuts axially with zero side rake.

In the machining of hard bronze by processes other than hobbing, top rake up to some 10 deg. has been found advantageous. In hobbing from the solid, the entering flanks and tips execute the major part of chip removal, with tangential feed. Hence the simultaneous provision of top and side rake on the hob teeth may likewise be argued to be desirable, provided it is not made excessive.

This may be provided at the tip and root by using normal convolute helicoidal tooth faces instead of normal screw-helicoidal faces. The front or top rake in the transverse plane is $\arcsin \frac{a'}{\rho_T}$ at the tip, and increases as ρ diminishes, so is greater on the roughing group tips than on those of the finishers. The keenness of the entering flank may be increased by increasing the gash lead, at the expense of reducing that of the trailing flank.

Thus, for preliminary consideration, the gash lead may be set by taking a z value equal to or somewhat greater than ρ_T, that is,

$$L_s \text{ (preliminary)} \gtrsim \frac{4\pi^2 \rho_T^2}{L_w} \quad (30)$$

Final determination of this value rests with the availability of certain gears for the relieving gear train, as will presently be described.

Likewise the base circle for the normal convolute helicoid of the tooth faces, for say 10 deg. rake at the tips, is from Equation 22 as follows:

$$a' = \rho_T \sin\left(10° - \arctan\frac{N_w\, d\phi}{T_\phi \rho_T}\right) \quad (31)$$

Whether screw or convolute helicoidal tooth faces are chosen a suitable value for the included angle of the gash, in the transverse plane, lies normally between 32 and 38 deg., and can be most easily established by layout.

Additionally, the ratio of retracting to relieving time should be definitely known since the width of gash at the root of the teeth is established jointly by requisite space for a sharpening wheel and by this time ratio. For small hobs, the former is the criterion; for large ones, the latter.

It is safe to anticipate that between new and discard conditions, three-fourths of the tooth material will be lost by face grinding, and on this basis the original diameter of the hob may be the sum of worm diameter plus twice the root clearance plus sharpening allowance.

The sharpening allowance is established by the normal relief spiral passing through the tooth tip at the worm diameter plus twice the root clearance, continuing to the tooth face helicoid at the tips when new. What one might call the "life angle," encompassing three-fourths of the tooth material, may be directly measured from the layout referred to above, and designated σ_s, whence the radial sharpening allowance $\Delta\rho\sigma$ is given by

$$\Delta\rho\sigma = \frac{N_g}{n_c} \times a_c \times \sin\mu \times \sigma_s \quad (32)$$

(σ_s in radians)

The latter is a minimum when γ is a minimum, and a suggested value for the hobbing of bronze gears is $\gamma \simeq 2$ deg. and a_c as established by Equation 26 and the hob tips relieved with the slide set at angle μ.

Should cams of larger a_c value than minimum be used, the sharpening allowance is increased and the hob over-relieved. If the relieving attachment used is of the variable stroke type, and the resulting relief not Archimedean spiral, the angle γ should be specified and measured from the tooth face using a knife-edged templet.

With tools tilted out of the radial axial plane, with either type of attachment, Archimedean spiral relief is departed from, and except for control of relief from thread to thread, either type of attachment is suitable. With the variable stroke type, it is easy to increase relief on the tapered roughing group, and reduce it on the finishing group, whereas with the fixed stroke type, a cam change is involved to accomplish the same effect. The consequence of such procedure is that the increment material removed by the first finishers increases as sharpening is repeated.

Restrictions Imposed by Relieving Attachment Characteristics

In the relieving operation, work proceeds until a narrow land between 1/64 and 1/32 in. wide remains untouched on the coppered blank, activities then being transferred to adjacent threads, either by shift of carriage or by indexing the work, either of which maneuvers necessitates rephasing the relieving gearing. The manner of doing this depends upon the characteristic spiral produced by the relieving attachment and the size of the hob.

If Archimedean spiral relief be produced, the work may be angularly shifted by shift of the driving dog until satisfactory retraction conditions have been restored, accurate spacing of the basic threads having been established in the initial chasing operations, and relieving proceeds until equality of land extent is established on the second, and in their turns, any subsequent threads.

When Archimedean spiral relief is not obtainable, it is desirable to maintain mechanically the phasing of the relieving motion, and this desirability increases with increase of axial pitch of hob.

To this end the first driver of the relieving train should have its number of teeth an integral multiple of the number of hob threads. If this cannot be accomplished with the hob as initially proposed, trial should be made of various L_z values which, substituted in Equation 7, finally permit such a first driver. The corresponding z value should be kept in mind so as not to overdo the side rake feature, though z changes slowly with change of L_z.

Such a gearset having been established, after the first thread is relieved the work is indexed $\frac{1}{N_w}$ — turn with respect to the lathe spindle, and the first pair of relieving gears remeshed $D_1 \div N_w$ teeth from their initial setting, D_1 being the number of teeth in the first driver, and relieving continued.

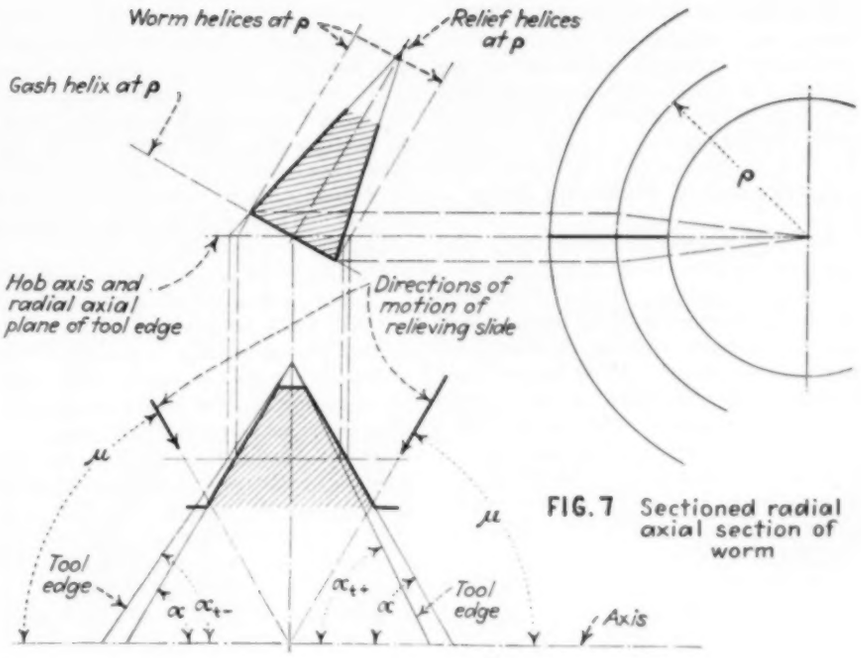


FIG. 7 Sectioned radial axial section of worm

Should it become impossible to obtain driving gears having the number of hob teeth as a factor, an indexing hub should be provided for D_1, and the phase changed simultaneously on both work and driving gear.

The interposition of an auxiliary reduction gear on the lathe merely requires that the normal remeshing shifts be multiplied by the reduction ratio of such auxiliary means to determine phasing movements.

An indexing faceplate, and relieving change gear hub was described in *American Machinist* as far back as 1917 by the author.

Some older types of relieving lathe drive the cam from the tail end of the leadscrew. The change gears for relief are obtained as follows: The number of teeth relieved per work revolution is N_R, and the number of turns of the leadscrew required for this relieving is $L_w \div$ lead of leadscrew, which for example is, say, ½ in. When the mechanism has made N_R reciprocations, the turns of the camshaft have been $N_R \div n_c$, and since both occurred in the same time, the products of these numbers of turns times the numbers of teeth on their respective gears are identical, whence the relieving gear train is

$$\frac{\text{Drivers}}{\text{Followers}} = \frac{N_R}{2\, L_w\, n_c} \qquad (33)$$

The peculiarity of this set-up is the series arrangement of the relieving and chasing change gears, complicating any phasing scheme. However, such lathes as the writer has seen of this type incorporate Archimedean spiral relief, so phasing trouble passes out.

Relieving attachments embodying a drop off type of cam are usually irreversible, and reversibility of the lathe is essential for phase maintenance. To take care of this situation it should be possible to lift the cam follower out of contact with the cam when the lathe is reversed, or to provide a single position ratchet drive in the cam drive mechanism. Failing these, the drop off cam should be replaced by one having reversible characteristics.

Relief Grinding the Teeth

Relief grinding of worm gear hob teeth will not cure their tendency to produce gears of variable tooth shape over their life. The object attained by this refinement is the straightening up of drunken teeth and the systematic achievement of tooth grading for width.

Necessity for such extra work may be readily established by indicating the suspected edges in a lathe, geared up to the appropriate leads, and reading on the indicator departures from the designed Δf.

Slightly tipsy teeth may be initially neglected, but those that are really too much out are subject to correction. The usual means is a pencil wheel trued first to templet and later corrected by and after examination of the marks left on the work as relief grinding proceeds.

Screw-helicoidal hobs may be ground with conical wheels dressed to angles α_f of Equations 28 and 29. The fact that the pencil wheel has some curvature while the tool edge has zero radius of curvature does introduce a very small error.

Discrepancies produced in gear tooth shapes cut during the life of a relieved hob may be primarily occasioned by the fact that it *is* relieved. Attention then has been drawn to the idea of making hobs without relief.

Clearanceless Finishing Hobs

Standard practice in hobber operation has long been to tilt the hob spindle out of designed position of the worm axis to change favorably tooth contact, but not with complete success. For the best grade work, the use of the tapered hob is followed by the use of a reamer hob, not to be confused with the old fashioned worm-shaped file, the burr hob.

Reamer hobs may be of different designs. Some consist of worms axially slotted after hardening and grinding. Others have sharp edged grooves cut along the generatrices of the worm helicoids prior to these operations.

In the axially slotted type of finishing hob, tool steel blades may be driven tight to form topping blades, making possible the simultaneous finishing of the tooth flanks and providing a concentricity-checking surface.

The essentials of their use follows. They are caused to cut by the application of interference tendencies either after having been fed radially to depth or during tangential approach to position. The interference tendencies may be either externally applied, resisting torques about the gear axis, or forced phase change by remeshing the gearing if done in the hobber. Usually one flank of the gear is cut first, rotation and sense of restraining torque both reversed and the other flank finished.

The reamer hob cuts until the humps on the teeth are removed, when the tooth flank bears upon the helicoidal face of the hob and cutting practically ceases. The material removed is slight and the life of such tools extremely long.

The hobs described by Nikola Trbojvitch (*AM*—Vol. 75, page 348) combine the cutting and the reaming feature in one hob, and to the knowledge of the writer have been very successful. Similar results may be obtained by hobs chased either tapering, or with long and short flank leads, finished on the worm grinder.

The principal difference between such hobs and those described in the source quoted are that in the tapered or graded hob, the degree of grading is established independently of the amount of relief, whereas in the latter it is consequent to and varies with this figure.

The effect of sharpening upon such hobs is to increase the Δf value between the last rougher and the first finisher of each group of teeth. This latter effect is of negligible importance because:

The contact between the hob and the gear is similar to that of worm and gear. The hob, however, if a cutting hob, has only its edges on the worm helicoid, and its contact lines are a series of points. In the burnishing hob, of any of the last three types, these contact points become very short surfaces, because of the land on the hob and the interference material in the gear co-existing.

However, the whole land of any one tooth cannot possibly be in contact with the gear tooth flank at any one instant, so that undue heating is remote.

Should the use of combination hobs be contemplated, the length of finishing zone may be increased over that suggested in Equation 12, in order to have finishing lands on two threads or more in simultaneous contact with the gear through the finishing zone. By so doing the hobber drive is steadied and surface finish somewhat improved.

However, for exceptionally high quality and uniformity of gears produced, the subsequent use of the clearanceless finishing hobs described earlier in this section is perhaps the best, though the most expensive, procedure.

Durability of Hobs

Assuming uniformity of gear material, well heat-treated good steel in the hob, and absence of abuse in its use, design work is not complete when delivery of the hob to the manufacturing department has been made.

Much may be learned from careful examination of the hob upon the occasion of its first sharpening. The individual teeth will dull locally at rates approximately proportional to the local work done and somewhat inversely proportionally to the rate at which heat may be conducted from the cutting edges back into the body of the hob tooth. Examination will usually reveal irregular local dulling, improvement of which condition may in some instances be accomplished.

If the finishers dull too fast, either Δf is too great or the outside taper of the roughers too steep or these two occur in combination.

If the last roughers dull faster than either the first roughers or the finishers or both, the hob may be re-relief-ground on the roughing tips and the corners broken a little more smoothly to cut down the local duty imposed on them. This operation does not affect the σ_s value (see Equation 32) as would regenerate grinding the tooth face helicoid in the roughing zone to provide more top rake on the tips. Besides, the latter has to be done each time the hob is resharpened whereas the re-relief grinding, once established is good pretty well for the life of the hob.

Hobs for general use, cutting gears of widely varied numbers of teeth, need relief for the minimum numbers of teeth or blank diameters expected to be hobbed, and the above type of investigation and modification should be applied to these latter with caution.

Combination roughing and finishing hobs may have gash modifications ground in them without cause for worry until the finishing tooth lands are removed completely.

It is often found that slight alterations greatly increase the numbers of teeth hobbed per sharpening, hence it is important on repetitive work to keep close watch of the performance of such modifications as may be made and incorporate the desirable ones in the hobs built subsequently.

The foregoing analysis and comment may perhaps create the impression that good worm gearing either "just ain't" or is too costly to bother about. Neither of these notions is borne out by the facts. Good worm gearing is essentially a first class thrust bearing that is forced by conditions to assume the form of gear teeth.

The presence of excess quantities of powdered bronze in the worm gear housing after a short run is evidence of one of the following, assuming that lubricant was put in to the proper level: poor tooth proportioning with respect to torques transmitted, poor cutting or poor mounting. The best hobs in the world will not cure faults of the former or the latter, but it is believed that cognizance of and action based upon the several points brought up in the foregoing treatment will result in somewhat better quality of product.

The fact remains that in few other details are the engineering and manufacturing problems so closely interwoven as in high-duty worm gear manufacture.

A New Use for Cellophane

WINFIELD W. BLAKEMAN
Superintendent, Blanchard Machine Company

If you have never used strips of colored cellophane, 0.001 in. thick, placed under a straight-edge as feelers for checking flatness, try it and you will be pleasantly surprised. The smooth surface of cellophane permits it to be "pulled" easier than does tissue paper, and it is less likely to tear. It is available in thinner sheets than is tissue paper, so that smaller variations in flatness can readily be determined.

Colored cellophane should be used because the colorless kind is so transparent that it blends with the surface being tested and is almost invisible. Any color that strikes the fancy can be used.

Developing Blanks for Bending and Forming

C. W. HINMAN

Sheet-metal blanks to be bent or formed can be accurately developed by careful figuring. The grain direction of the material can safely be ignored, since the design of the blanking tools has generally provided for the blank to have an angular position in the strip, with the view of having all bends come across the grain. If there is any doubt about the length before and after bending of an unusual material, it is better to bend several test samples in the bench vise, and then to adopt average results.

Blank developments for bending are computed from inside the bends, using the dimensions given in the drawings of the parts. Add the distances between the centers of the inside radii and the allowance x for each corner bend. The developed length for bending or forming is the computed length of the neutral bending line, which is located at one-third the thickness of the material from inside of the bend.

All the inside radial bends in Fig. 1 are $\frac{1}{32}$ in. Consulting a table for sheet-metal bends for material $\frac{1}{32}$ in. thick and for the given radius, the length of material required for 90-deg. bends is given as 0.065 in. It can be calculated from the formula: $x = (R + \frac{T}{3})\ 1.571$. For other angles, x is directly proportional.

If we consider sections *A-A*, *B-B* and *C-C*, Figs. 2, 3 and 4, and find the developed lengths for them, it is obvious that other necessary dimensions will follow. These sections can be sketched free-hand, but if the work is small they should be laid out five or ten times the actual size. Following the given method, the developed lengths for these sections are 3.041. 4.448 and 3.318 in., respectively.

Since the work illustrated in Fig. 1 will be made in two operations, the first operation will be "throwing up" the outer bends, while in the second operation, the four inner bends will be made, completing the work. In Figs. 2 and 3 are given the developed dimensions for the inside bends in the first operation, which also determine the sizes for the forming punches, as 2.748 and 3.505 in. for sections *A-A* and *B-B*, respectively.

These dimensions were determined by the given method and were computed to the beginning of the last outer bends, and the radius at each end was added. For example, in Fig. 2, 0.635, 0.054, 1.385, 0.065 and 0.453 in. were added, totaling 2.592 in. Adding the $\frac{5}{64}$-in.

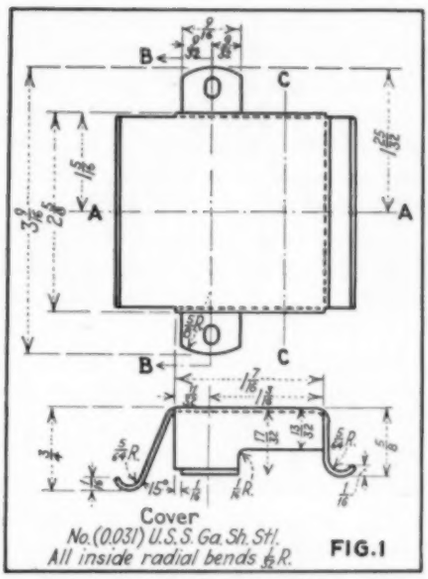
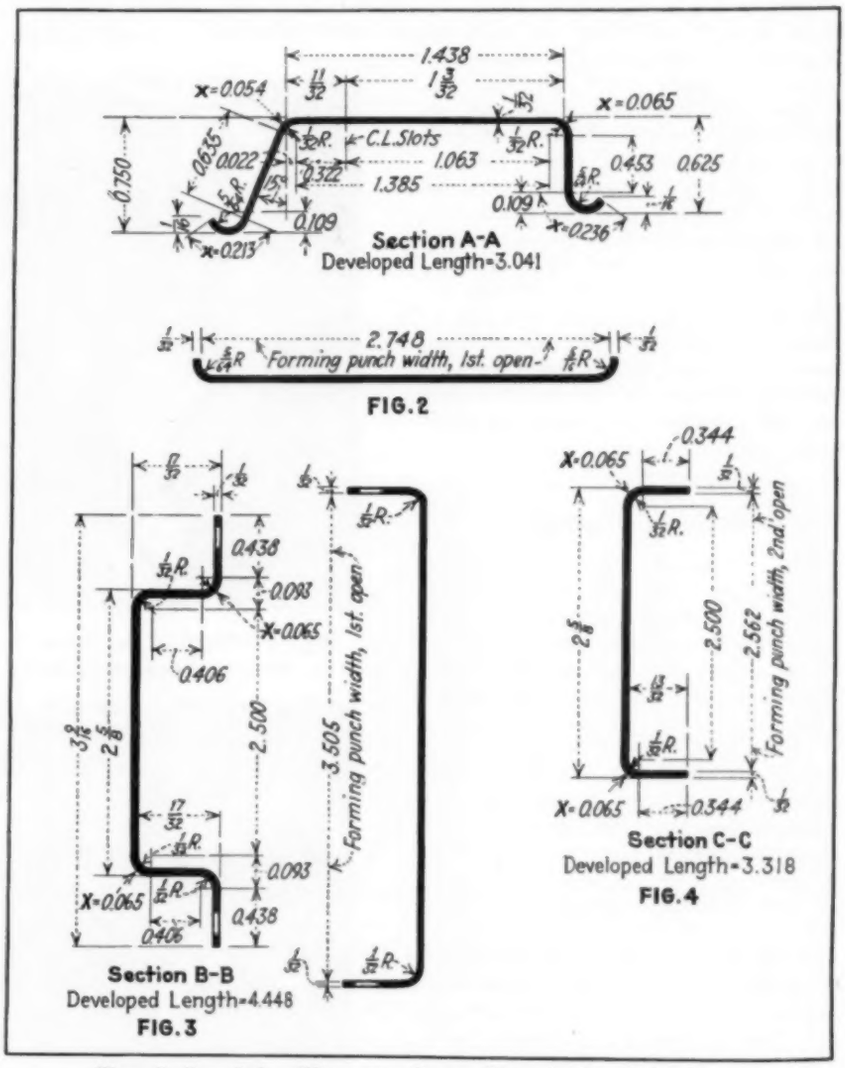


Fig. 1—Parts drawing of a cover made of 1/32-in. sheet steel for which a blank is to be developed



Figs. 2, 3 and 4—Allowances for making the bends in developing the blank for the cover in Fig. 1 are clearly shown. Only simple arithmetic is required for calculations.

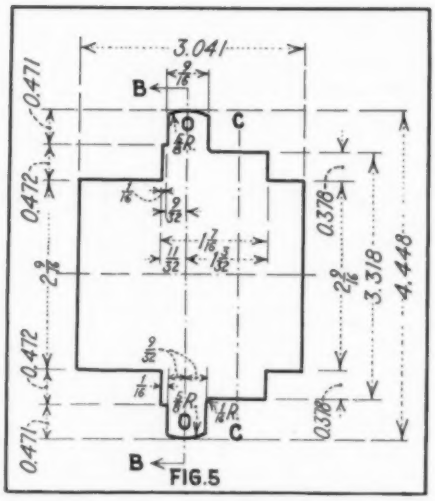


Fig. 5 — Upon completing the blank development, a sketch like this should be made, both for reference and as an aid to the diemaker

radius at each end brings the total up to 2.748 in., which is the distance between the inside bends for the first forming operation. Section C-C has no first forming operation, being completed in the second-operation forming tools.

To complete the development, a sketch as in Fig. 5 should be made. All the dimensions found for the three sections should be supplied. The remaining dimensions can be taken directly, or they can easily be obtained from Fig. 1. Blanks computed in this manner and carefully checked, as outlined, are surprisingly accurate in shop practice and will save much time in making the press tools.

What is a Spiral?

When it comes to gears and springs the average shop man gets woefully twisted as to which is spiral and helical. Many use the terms interchangeably. To others any gear that has skew teeth is a spiral gear. And even some of my college friends are not quite sure which is which in all cases. We agree that a spring or a gear with teeth at an angle to the axis, is a helix as long as it is of uniform diameter. We also agree that a clock spring is a spiral. But when we come to a spring wound on a cone, as with some bed springs, or a taper hob, or even a pipe tap, nobody agrees with anyone else. One professor friend calls them all spirals as soon as they deviate from a uniform diameter. Others call them a tapered or conical helix, while some insist that they are helicals until they become a true spiral. One splits the two at 45 deg. What is your guess?

Special Operations on Special Motors

Welding plays an important part in the building of the Allis special motors. This is borne out in Fig. 1 where stators are being built up by the welder at the right. At the extreme left is a plain stator with short steel rings welded to the ends and both supports and feet, also welded in place, making a complete arc welded job. A tube for protecting the lead-in wires is also welded to the side.

The other stator has special cooling projections welded around the outside of the stator laminations. The solid strips divide the spaces into definite sections to aid in the ventilation of enclosed motors. A study of the base and the supporting members will show how the stator ring is held up to allow air space beneath. The whole layout indicates that the work is done in very compact quarters.

One of the ways in which machining cost is reduced is seen in Fig. 2. Two independent tool blocks are mounted on the bed, supported by welded bases, each block having its own motor. In this way the outside ends of the stator are turned by two tools, one at each end, each being fed by the small motor through suitable reduction gearing. Although the tools may seem to have considerable overhang it will be noted that the cutting bit is held in a massive head which is supported by a heavy shank. As indicated by the short travel, the work of these tools is confined to special turning operations at each end of the stator. With the stator held on substantial driving and supporting centers, the lathe proper simply turns the work against the cutting tools. This method has proved very satisfactory in every way.

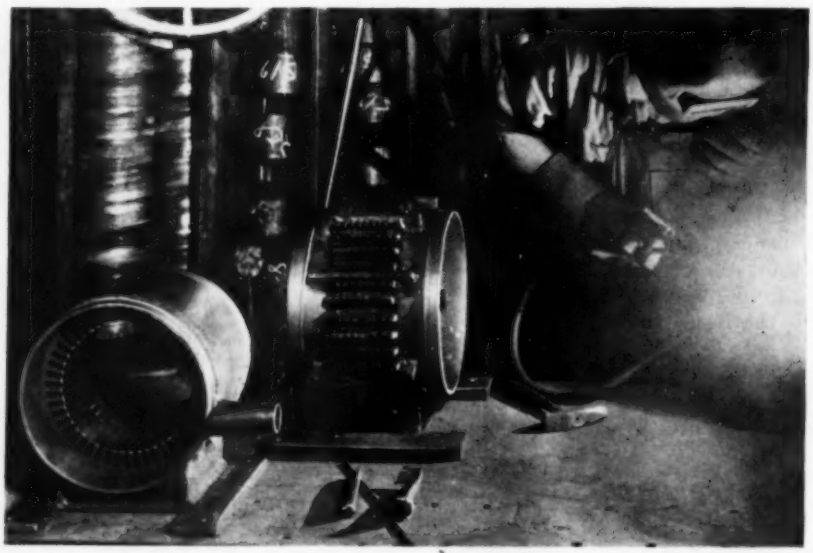


Fig. 1—Welding the frame and feet of special motors. Note the sleeve for protecting lead-in wires and the cooling projections

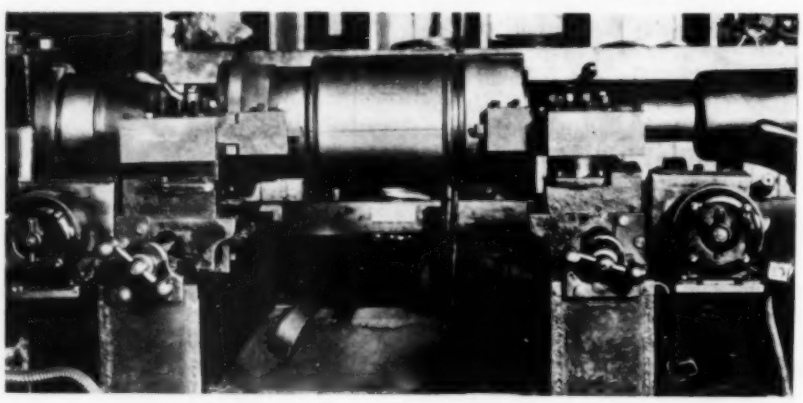


Fig. 2—Two tool heads with slides are mounted so as to turn both ends at once. Each has individual motor feed

EDITORIALS

VOLUME 78 AMERICAN MACHINIST NUMBER 15

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McGRAW-HILL PUBLISHING COMPANY, INC.

K. H. CONDIT F. H. COLVIN

EDITORS

Army and Navy Orders

FOR QUICK relief of unemployment no better way to spend federal money has been found than through the placing of machine tool and equipment orders for Army and Navy arsenals and manufacturing plants. As detailed in a news article on one of the following pages, the Navy spent $2,100,000 for machine tools last year, distributed the business relatively evenly over many months, and allocated it to 87 companies in 17 industrial states. No one in the metal-working industry needs to be told again how many hours of productive employment resulted.

Now, both the Army and the Navy are ready to place similar orders if PWA funds are made available. The need is great because much of the existing equipment is hopelessly antiquated. The benefit will be immediate because the plans and specifications are ready and the orders can be placed at once.

For these reasons every effort should be made to convince the PWA executives that these loans should be extended at once. If necessary some of the more dilatory non-federal public works projects ought to be sacrificed because they are such slow producers of unemployment relief. Every one in the industry who has a contact with PWA should make it known through that contact that the granting of these loans will be productive of the maximum benefits where help is most needed.

Checking NRA

ADVISED by the President to take a vacation, General Johnson has set up a "board of directors" of five to run the NRA machinery in his absence. Whether his threatened speech-making tour can be counted as a vacation is something for him to settle with his chief. It is of minor importance compared with the opportunity to find out whether NRA will function at all without the administrator. If it will not, then something even more drastic than the recent retreat from the service industries, the later ban on open pricing, and the latest executive authorization of a cut of fifteen per cent on government bidding must be done.

For the third time the New England Council has questioned its members on the effects on themselves of their NRA codes. There is encouragement for General Johnson in the vote of four to one for some permanent form of business code. Of the other conclusions to be drawn from this survey, the most important are that minimum wage regulation has been found to be helpful, that maximum hour provisions are a decided nuisance, that compliance difficulties under the simpler codes are much less frequent than under the complicated ones.

One of the surprises in the voting is the majority opinion that the collective bargaining requirement, the notorious Section 7 (a), is "of no effect." The New England Council interprets this vote to mean that labor relations in New England are on a sound cooperative basis.

Other conclusions, which are not surprising, are that price stabilization plans and restrictions against selling below cost have not been successful. From the beginning unbiased critics have maintained that these provisions in NRA codes were unenforceable and therefore impractical.

General Johnson is reported to be working on a plan for a government-supervised, industry-operated code system to succeed NRA as a permanent affair. The New England Council survey should be helpful in indicating what changes are necessary, and should be backed up by other and broader surveys.

Funds for Standards

SOUND judgment is displayed by the Committee on the National Bureau of Standards of the Business Advisory and Planning Council of the Department of Commerce in a report which recommends increased funds for the Bureau. Routine testing for other government departments, which is done without cost, absorbs about forty-five per cent of the annual budget, and has increased during the last few years. The natural result of the freezing of this proportion of the Bureau income is that its other activities have had to be drastically curtailed. Since 1932 the reduction in available funds for this other work has been approximately seventy per cent.

From the personnel standpoint this curtailment of funds and activity has cost three hundred trained scientists their jobs. It has also reduced efficiency materially, because men in the lower brackets were furloughed and their work has therefore had to be done by the higher salaried men who are left.

But the most serious aspect of the situation is that much of the important research and investigation work that can best be done at the Bureau because the equipment and the scientific personnel are there has had to be abandoned. We can think of no better use for a moderate amount of PWA money than to

allocate it to this important scientific and engineering investigation. The Bureau officials have proposed eight projects and these projects have been endorsed by the advisory committee. They would make work for men in the metal-working industry as well as for those in the Bureau. Neither group has received much consideration under the New Deal.

Clean Plants

CLEAN windows and fresh paint not only help shop morale but are a direct aid in getting orders, according to the manager of one of the most successful machine building plants. He had been so busy keeping his bank balance from needing the oxygen treatment that he hadn't noticed the gradual accumulations on windows and wall. When he did, he spent several thousand dollars on cleaning and painting and his shop now looks spick and span.

As a result his men have absorbed a large dose of enthusiasm and faith in the future, which shows in their work and general attitude. Possible customers are impressed by the air of prosperity which gives confidence in the stability of the company and in its product. That this is not mere imagination is indicated by an increased percentage of orders from those who have visited the plant since it was spruced up.

.CHIPS.

Washington—Donald Richberg appointed chairman of special recovery coordinating committee to keep things going while the President is away . . . Rumors multiply that Johnson may be replaced by a commission at the head of somewhat demoralized NRA . . . Validity of NIRA will be decided by Supreme Court in October term . . . Republicans open campaign with attacks on bureaucracy and undermining of the Constitution . . . Executive order leaves last 5 per cent of wage cut to government employees in effect until 1935 . . . Johnson proposes code for remaining uncodified industries and appoints three of his assistants to rush them through . . . Howell Commission begins study of aviation situation.

Foreign—Hitler's ruthless suppression of revolt among his own leaders leaves him in the unenviable position of sitting on the safety valve of a people he has taught to believe that force is the one way to a decision . . . Murders of leading Catholics stir Rome . . . Ferocity of action drives Great Britain to open announcement of rearmament policy and strengthens ties with France . . . Communists foment serious riots in Amsterdam . . . French Parliament adjourns without acting on Treaty to end double taxation of American firms in France . . . Many heads of such firms consider retirement from France . . . Cuban general strike a fizzle . . . Hitler assembles his one-party Reichstag to hear all about the "liquidation" . . . Soviet abolishes OGPU, no longer needed . . . Dollfuss reconstructs cabinet to fight Nazi inroads.

Finance—Economist of American Petroleum Institute claims that American tax per capita, 25-30 cents on the dollar, is the highest in the world . . . Governor Harrison of the Federal Reserve meets with board of International Bank at Geneva, confers with Montagu Norman . . . Nearly 25 per cent of all R.F.C. loans have been repaid . . . Total internal revenue collected in fiscal year ending June 30, 1934, was $1,000,000,000 more than in the previous year.

Industry—Pennsylvania R.R., acting under new amendments to Railway Labor Act, sets up board of 18, half from management, half from men, to adjust disputes in the engine and train service divisions . . . 70 per cent of shop employees on all railroads represented in brotherhood, independent of A. F. of L., organized by delegates from 25 Western roads under Labor Act amendments . . . San Francisco longshoremen's strike threatens to become general as guardsmen protect state-owned railway and docks . . . Clash between pickets and workers closes Caterpillar Tractor foundry in East Peoria . . . B. & O. orders mechanical refrigeration for 31 more cars . . . PWA work loans are now paying the wages of 20,000 men in railroad shops and keeping twice as many others busy in plants of materials suppliers . . . Westinghouse gets $1,700,000 order for propelling machinery for seven coast guard cutters . . . Merger of Republic Steel and Corrigan-McKinney will be put up to directors and stockholders shortly . . . Republic announces that it will not renew contract with unions that has existed for twenty years . . . Weirton superintendent charges five leaders of steel union with intimidating witnesses.

Trade—Macaulay announces definitely that the automobile industry will hold no national shows in January . . . New York show will be staged by dealers and is planned along usual lines . . . U.S.-Soviet trade has dwindled almost to nothing as result of political debt dispute . . . Cotton and grains rise on strength of small crop forecasts . . . Trade with Far East rose materially in first five months of 1934.

Indicators—Steel production recovers to nearly 30 per cent following holiday week drop . . . Carloadings reached a peak for the year in the week ending June 30 . . . Electric power production down in holiday week but still one per cent ahead of 1933 . . . *Business Week's* index off several points to 60.7.

Army and Navy Seek PWA Funds for Shop Equipment

Encouraged by the satisfactory way in which the 1933 PWA appropriation of $2,100,000 for machine tools for Navy plants stimulated employment and increased Navy plant efficiency, the Navy is applying for an additional $3,500,000 and the Army for $2,500,000 for the same purpose. Because this money can be transformed into employment immediately, it is recommended that PWA funds from inactive non-federal projects be diverted to the Army and Navy.

In his brief supporting these applications for PWA money, H. H. Lind, general manager, National Machine Tool Builders' Association, makes these points:

I.—Effect on Employment

(a) Army and Navy studies of requirements are now completed in detail to the point that contracts can be made promptly and work in plants started immediately.

(b) This would employ technical men and skilled artisans not ordinarily reached by Public Works programs. These men are important factors in the present industrial period and have been hardest hit during the depression.

(c) An analysis of the Navy appropriation of $2,100,000 of last September discloses that machine tool orders went directly to employ men in 87 different plants in 17 states, and indirectly this was divided much farther.

(d) In the case of the Navy appropriation, it would put men to work in the actual construction of ships much more rapidly for the reason that the vessels themselves require much equipment of an intricate character, and ordnance to be built in Navy Yard plants. Their present inadequate machinery is certain to delay deliveries of needed parts to vessels, thus interfering with progress and employment on the actual vessel construction.

(e) Purchase of machinery for Government plants in low volume periods is not only effective in putting men to work in the low period but lessens the requirements for overtime and rush production in peak periods when production facilities are strained and skilled man power is scarce.

II—Value to the Government

(a) It is an expenditure by the Government for equipment badly needed in which the ownership goes to the Government and savings accrue to the Government.

(b) Machinery in Government plants is in the main very old; some of it still in use is 40 or 50 years of age. The accuracy requirements of modern ordnance and equipment demand production on modern machinery. Continued use of obsolete equipment is wasteful and becomes still more costly in the effort to produce parts of extreme accuracy.

(c) Installation of some new machine tools in each of the Government plants will progressively educate the workmen in the handling of these tools in preparation for an emergency.

(d) Rehabilitation by the Government in its own plants would give leadership to rehabilitation in private industry.

(e) It is evidently the policy of the Government to depend in the future to a larger extent than in the past on Government shops for the production of Government ships and Army and Navy ordnance. These plants should then be brought up to the state of effectiveness possessed by private institutions engaged in the same line of work. Government plants are now far behind in this respect.

Colonel Chevalier Appointed to Sewing Machine Authority

According to a recent announcement by Recovery Administrator Hugh S. Johnson, Colonel Willard Chevalier, vice-president of the McGraw-Hill Publishing Co., and publishing director of *Engineering New-Record*, has been appointed administration member of the code authority for the sewing machine industry. R. P. Barry, former private secretary to Stuyvesant Fish has been named as government member of the code authority for the flexible metal hose and tubing manufacturing industry.

Professor R. H. Danforth, of the Case School of Applied Science, has been appointed to represent the administration on the code authority for the small locomotive manufacturing industry. Edgar E. Brosius, president and general manager of the Edgar E. Brosius, Inc., manufacturer of blast furnace equipment, was made administration member for the railway and industrial spring industry, a sub-division of M.A.P.I. Ralph S. Foss, publishing director of the *Harvard Business Review*, McGraw-Hill Publishing Co., has been named as administration representative for the beauty and barber equipment and supplies trade.

Federal Reserve Bank Loans to Industry

In compliance with the June 19 amendments to the Federal Reserve Act, Governor Black of the Federal Reserve Board has issued regulations governing applications for and approval of loans to industry. Provision is made for the details involved in the type of loan where the Federal Reserve acts in support of a private bank. This is looked upon as the usual procedure.

Direct loans are considered as emergency measures. Applications for such loans must be made to the Federal Reserve Bank of the district in which the applicant is located. They will be passed on by the Industrial Advisory Committee of that district. The following regulations are to guide the bank officials in passing on a loan application:

Grant or Refusal of Application.—In making any loan to or purchasing the obligations of any established industrial or commercial business or making any commitment with respect to such a loan or purchase, the Federal reserve bank shall ascertain to its satisfaction:

1. That the circumstances are exceptional;

2. That the obligor upon the obligation to be purchased or to evidence such loan is an established industrial or commercial business located in its district;

3. That the proceeds of such loan or purchase are to be used to provide working capital for such business;

4. That such obligor is unable to obtain requisite financial assistance on a reasonable basis from the usual sources;

5. That the financial condition and credit standing of the obligor and indorsers, if any, upon such obligations, and the value of the security offered, if any, justify the granting of such accommodation on a reasonable and sound basis; and

6. That the transaction will comply with the requirements of the law and of this regulation with regard thereto and, in so far as such reserve bank may be able to ascertain, does not involve a violation by any person of the provisions of section 22 of the Federal Reserve Act.

July Shut-Downs Cut Auto Production

DETROIT—With Dodge, Hudson, Studebaker, Chrysler, Ford and Graham, closed during the first week in July due to the mid-week holiday, and Chevrolet and Plymouth operating on a reduced schedule, July gets away to a bad start. Output for the week ending July 7 is estimated by *Cram's* at slightly better than 30,000 as compared with 80,936 for the previous week. Despite this initial set-back, July output is expected to run above 250,000. July 9 marked the resumption of operations.

Meanwhile figures for June indicate that production for the first six months of 1934 expanded roughly 70 per cent over the same period last year. Plymouth retail sales expanded 60.5 per cent over the first half of 1933, Buick nearly 100 per cent, Dodge 70 per cent, Chevrolet 50 per cent. Increased advertising and merchandising appropriations must be made to keep cars moving, and considerable opposition is registered against fixed trade-in allowances in the retail code which has hindered sales especially in the high-priced range.

The annual auto shows in New York and Chicago are to lose their designation as national shows although they will be sponsored by the automobile merchants association according to an announcement. Whether these will operate as part of the plan to have 100 shows over the country at the same time is not clear. Final ratification of this announcement will be made July 30 at the N.A.C.C. board meeting. In some quarters this change is not expected to have much influence on the introduction of new models; dealers will still be pressing for something new to show. There is little likelihood that there can be any general agreement as to the spacing of models; no company could afford to hold to an unpopular model till its assigned period returned a year later.

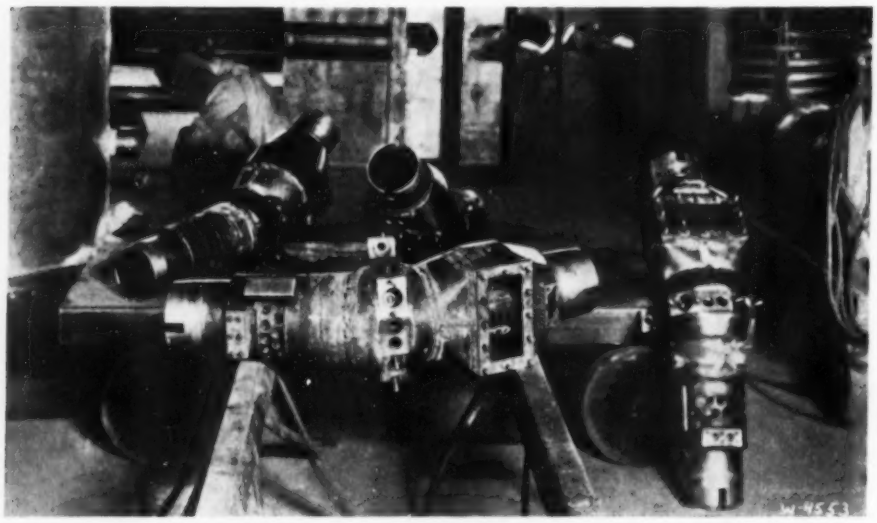
In the General Motors line, Oldsmobile operated as the style leader for two years; this year LaSalle assumed the role; which car will be picked to lead the procession in 1935 is a matter of speculation—perhaps Pontiac. DeSoto and Chrysler air flow models have been playing a similar role. It can reasonably be assumed that the bread and butter cars of these groups will follow these advanced lines only on demonstrated consumer preferences.

Continued pressure is being placed on suppliers for price concessions ranging from 5 to 10 per cent—in some cases this being demanded. Success in maintaining prices depends upon the strength of supplier organizations. With first-hand experience as to the danger of increasing retail automobile prices there is little likelihood that this pressure will be released when new models are being figured.

Spreading steel business is a strategic move in the fight to make Detroit a basing point; meanwhile the National Steel Co. announces a $12,000,000 addition to its Ecorse plant for the continuous production of cold and hot strips in large dimensions for the automobile plants. Rotary Steel will also expand in Detroit. Evidence is thus shown that confidence in the labor situation and in the soundness of the automobile industry is strong.

Tool and die shops have some new business, but generally designs are not settled. One shop has added 150 men within the last few days and expects to add 100 more within the next 60 days. With 80 per cent of the larger and more expensive equipment required for body dies concentrated in the Detroit area, Detroit shops are in line for the new business, especially with labor relations more satisfactorily established.

Bonus incentive plans are decidedly losing ground in favor of straight hourly rates as workers and management adjust differences through works councils. Daily rates are set on the basis of past bonus percentage earnings. This results in greater evenness of earnings from the starting of new work till operations are running satisfactorily.



***Welded Diesel*—Since both weight and space are at a premium, F. B. Stearns, of Cleveland, is using arc welded steel for the cylinders of an experimental 320-hp. marine type diesel. Some sixteen pieces are required for each cylinder, the inner sleeve being case-hardened. Arc welding was done by the Thorton Co., using Lincoln Electric equipment**

Navy Contracts to Be Announced Soon

Proposals for the construction of 24 vessels will be publicly opened at the Navy Department at noon, August 16.

The vessels to be constructed under the 1934-35 program as authorized by the act of Congress of February 13, 1929, will include:

1 heavy cruiser not to exceed 10,000 tons with 8-in. guns. The keel of this vessel cannot be laid until January 1, 1935, under terms of the London Naval Treaty.

3 light cruisers, not to exceed 10,000 tons with 6-in. guns.

Funds for the construction of 20 smaller vessels are to be provided from appropriations under the Public Works Program, as authorized by the Vinson-Trammell bill of March 27, 1934. According to this act the first and each succeeding alternate vessel of each category must be constructed in a government yard. These vessels are:

2 heavy destroyers, not to exceed 1,850 tons.

12 light destroyers, not to exceed 1,500 tons.

6 submarines, about 1,300 tons each.

General Johnson Resells the Blue Eagle

WASHINGTON—Reversing the procedure of another famous general, Recovery Administrator Johnson initiated his latest campaign at Waterloo (Iowa). Though not attempting to found an empire, his mission is none the less one of conquest—to recapture the loyalty to the Blue Eagle, won less than a year ago but more recently showing symptoms of coolness. The General told his farmer audience that NRA had done more for them than "all the billions spent on your behalf by all other departments of government put together."

On the same day the long-heralded "basic code" was offered to virtually all industrial groups not yet coded and a 30-day deadline set for the completion of other code making. In force now are 476 codes covering more than 90 per cent of industrial and trade employment. The cleanup plan will include 262 codes now pending and will be supervised by a special committee of three, consisting of Robert K. Strauss, Leon C. Marshall and George S. Brady.

The "basic code" specifies a 40-hour work week but leaves the wage rate blank to be filled in by the particular industry accepting it. Those electing to adopt it will operate under a general code authority to be appointed by the Administrator.

During the General's absence the newly appointed NRA advisory council, headed by Dr. Walton H. Hamilton, former professor of law at Yale, will take the helm. Other members are Sidney Hillman, D. W. Tracy and John Frey, of the Labor Advisory Board, George Mead, R. Douglas Stewart and DeLacy Kountze, of the Industrial Advisory Board and Mrs. Mary H. Rumsey, Willard Thorp of the Consumers' Advisory Board.

Before summer has flown, the two major administration measures designed to promote recovery through the stimulation of private business will be tested. The home-modernization program and the loans-to-industry plan constitute a new kind of pump-priming as contrasted with direct Federal expenditures, and loans to states and municipalities by PWA.

Housing Administrator Moffett made a guess that the home modernization program will be under way in less than 30 days, and he is confident that the goal of half a billion spent in home repairs by Fall is not beyond reach. "It is a real selling campaign in which, fortunately, the heavy industries are interested and other industries will lend a hand," he said.

With the government good for losses up to 20 per cent, Moffett expects private sources to loosen up. He has Walter Chrysler's word for it that the automobile industry and others not directly concerned should benefit.

Moffett sees possibilities in industrial renovation, paralleling the home modernization campaign although not part of it. He thinks there is a ready market for modernization of this type among corporations having large surpluses with large depreciation items against them.

If direct loans to industry are to provide employment on a large scale by winter many large advances must be made promptly. Though RFC may not loan more than $500,000 to a single applicant, by participating to that extent in loans to which the Federal Reserve and private banks may be parties, it will be possible to make large single loans.

The first money to be put out under the act will go to concerns that have been granted mortgage loans under the old act. As some of the concerns can be better served under the direct loans, the RFC is encouraging such conversions.

To draft a comprehensive air policy a special commission appointed by President Roosevelt has already begun work. Clark Howell, Atlanta publisher, is chairman. Other members are Edward P. Warner, former assistant secretory of the Navy and who is taking a leave of absence from his present job as editor of *Aviation*, Franklin K. Lane, Jr., World War aviator, Albert J. Berres, former official of the A. E. of L., and Jerome C. Hunsaker, retired naval man.

Senator Thomas' cable warning Governor Harrison of the Federal Reserve Board not to stabilize the dollar with respect to foreign currencies was made apparently with an eye to its political connotations. It seems certain that both sender and receiver knew that power to alter or fix the dollar had within limits been put into the hands of the President by Congress. While neither Mr. Harrison nor Montagu Norman, of the Bank of England, could be expected to make public their recent discussions, it seems likely that the equalization funds of their respective countries formed the chief topic of conversation. Senator Thomas' wire, however, serves to indicate that the inflation bloc is not yet through.

• INDUSTRIAL REVIEW •

• Perhaps it is not a summer slump that has depressed machinery and machine tool sales to a discouraging figure, but something certainly has had the effect. Inquiries are still stirring in certain territories but no one in the trade expects much before September, and a few look for little the rest of this year.

• An occasional single machine tool is being bought in the Eastern territory and there are inquiries to work on, but generally speaking business is very quiet. Pittsburgh reports temperatures high and orders low and sees no immediate hope for improvement in either. Employment dropped in Cleveland, as had been expected, and little else developed except a Board of Education order for a fair number of small lathes, milling machines, drills, shapers and grinders.

• Although the machinery slump in Detroit is severe there is considerable optimism in automobile circles. Buying is on a hand-to-mouth basis in anticipation of a further relaxation of code regulation of prices. There is less fear that acute labor trouble will develop. In Cincinnati new business in machine tools is almost zero for many companies. Fortunately, some of them have small backlogs of orders to work on. From Indianapolis, on the contrary, comes word that the worst of the slump seems to be over. Distributors there look for increasing business soon and a very fair autumn.

• St. Louis reports almost no business in machine tools and a seasonal drop in small tool sales. The terrific heat is believed to be partly responsible. Chicago looks for better business in the fall but admits to extreme dullness now. Milwaukee says that business is still declining, very little being placed with metal-working plants.

Employee Relations Keynote of Silver Bay Conference

Meeting on August 22-25, at Silver Bay, Lake George, N. Y., the seventeenth-annual Conference on Industrial Relations will discuss the relation of government to business with particular emphasis on employee relations. Addresses to be presented include:

"Significant Changes in Employer-Employee Relations," Allen Gardiner, assistant to president, Forstmann Woolen Co.

"How has the NRA Influenced Recovery?" Ben E. Geer, president, Furman University, member, Textile Relations Board.

"The Extent and Trend of Unemployment," Roswell Phelps, Department of Labor and Industries of Massachusetts, Director Employment and Payroll Project, U. S. Department of Labor.

"Toward Unemployment Insurance," John Z. Andrews, American Association for Labor Legislation.

"Training in the Year Ahead," Harry H. Tukey, Congoleum-Nairn Co.

"The Rights of Employer and Employee in Collective Bargaining," Ordway Tead, editor of economic publications, Harper & Bros.

"How May Collective Bargaining be Accomplished?" (a) Contribution by outside unions—Emil Rieve, president, Full Fashioned Hosiery Union. (b) Contribution of the Employee Representation Plan—Noel Sargent, secretary, National Association of Manufacturers.

"Nationalism and Internationalism in Business," C. L. Marchison, director, Bureau of Foreign and Domestic commerce.

"What is Social Justice in Industry?" Spencer Miller, Jr., secretary, Workers Education Bureau of America.

"New Sound Ideas for Manufacturers," Henry P. Kendall, Kendall Co.

Closing address, Thomas C. Sheehan, director, Durham-Duplex Razor Co.

Donald Comer, president and treasurer, Avondale Cotton Mills, Morris Harrison, Hammermill Paper Co., Roy V. Wright, managing editor, *Railway Age*, C. S. Ching, U. S. Rubber Co., and Howard E. Coffin, director, Southeastern Cottons, Inc., will each preside at one of the sessions.

Approved Codes in the Metal-Working Industry

(Continued from AM—Vol. 78, page 380f)

Code Sponsor	Maximum Hours	Minimum Wages	Deputy Administrator	Approved Date
National Galvanizers Association	40	40c.; division of FMPF	King	May 17
Washing Machine Parts Manufacturers Council	40	40c.; division of MAPI	King	May 17
Steel Barrel Manufacturers Council	40	40c.; division of FMPF	King	May 17
Galvanized Ware Manufacturers Council	40	40c.; division of FMPF	King	May 17
Water Meter Institute	40	40c.; division of FMPF	Muir	May 17
Furnace Pipe Institute and Eastern Pipe & Elbow Manufacturers Association	40	40c.; division of FMPF	King	May 18
National Shower Door Manufacturers Association	40	40c.; helpers not less than 90 per cent of rate, office workers $16	Value	May 19
Bicycle Manufacturers Association	40	35c.; office workers $15	Janssen	May 21
Paper Box Machinery Division of the Packaging Machinery Institute	40	40c.; office workers $14-15	Brady	May 21
Wire Rope & Strand Manufacturers Association	40	40c.; division of FMPF	King	May 24
Flexible Hose & Tubing Institute	40	40c.; division of FMPF	King	May 24
Diamond Core Drill Manufacturers Association	40	40c.; division of MAPI	King	June 1
Mechanical Lubricator Association	40	40c.; division of MAPI	King	June 6
Contractor's Pump Manufacturers Association	40	40c.; division of MAPI	King	June 6
Locomotive Appliance Institute	40	40c.; division of MAPI	Martin	June 6
Water Power Equipment Association	40	40c.; division of MAPI	King	June 8
Rolling Mill Machinery & Equipment Association	40	40c.; division of MAPI	King	June 8
National Cutting Die Manufacturers Association	40	40c.; division of FMPF	King	June 9
Hoist Builders Association	40	40c.; division of MAPI	Muir	June 13
Hoisting Engine Manufacturers Association	40	40c.; division of MAPI	Muir	June 13
Kiln, Cooler & Dryer Manufacturers Association	40	40c.; division of MAPI	Martin	June 13
Association of Conveyor & Material Preparation Equipment Manufacturers	40	40c.; division of MAPI	Muir	June 20
Association of Lift Truck and Portable Electric Manufacturers	40	40c.; division of FMPF	Horner	June 24
Automobile Hot Water Heater Institute	40	40c.; 35c. for women; division of Automotive Parts & Equipment Manufacturers, Inc.	Ammerman	June 26
Association of Manufacturers in the Aluminum Industry	40	30 to 37½c. with differentials for women and southern states, office workers $12-$15	Kemp	June 27
Chemical Engineering Equipment Institute	40	40c.; division of MAPI	Martin	July 6
Association of Roller & Silent Chain Manufacturers	40	40c.; division of MAPI	King	July 6
Prison Equipment Research Bureau	40	40c.; division of FMPF	Martin	July 6
Power Transmission Association	40	40c.; division of MAPI	King	July 7
Caster & Floor Truck Manufacturers Association	40	40c.; division of MAPI	King	July 9

Machine Tool Orders Off Sharply in June

After having tapered off gradually for the first five months of the year, machine tool orders, as reported by the industry's supervisory agency, slumped severely in June. The down trend of business is attributed to labor troubles and general uncertainty about the future; exchange difficulties in Europe; and a tapering off of government purchases of machine tools.

Both domestic and foreign business suffered in the same ratio, the percentage of export orders at 23 per cent being the same as for the preceding month. For June the index of gross orders was 35.3, 10.6 points or 23.1 per cent under the May figure. Domestic sales fell to 27.4 from 35.4 for the preceding month, while the index of overseas orders dropped from 10.5 to 7.9.

The result has been to force a larger number of companies into the unfavorable position where their current demand is less than 20 per cent of their 1926 experience, upon which the new index adopted by the supervisory agency is based. In fact, for the first six months of 1934, 45 out of 166 companies reporting show a volume less than ten per cent of that for 1926.

INDEX OF ORDERS BASED ON VOLUME OF SHIPMENTS FOR 1926

Month	No. of Reports	Avg. Monthly Value of Shipments, 1926	Index of Orders			Per Cent of Foreign to Total Orders
			Total	Domestic	Foreign	
January	163	$8,084,351	53.7	43.9	9.8	18
February	163	8,084,351	50.9	40.5	10.4	21
March	163	8,084,351	48.1	40.1	8.0	17
April	163	8,404,416	46.5	36.2	10.3	22
May	160	8,280,603	45.9	35.4	10.5	23
June	166	8,421,746	35.3	27.4	7.9	23

General Johnson to Speak at Fourth Engineering Conference

Beginning Saturday evening, August 11, and lasting to August 19, the Fourth Annual Economic Conference of Engineers will hold a series of 25 scheduled meetings under the general theme, "An Economic Appraisal of the New Deal." As in the previous years, the conference will be held at the Stevens Engineering Camp at Johnsonburg, N. J.

At the final session of the conference on Sunday evening, August 19, General Hugh S. Johnson will speak, giving a message to the engineering profession. Other speakers include executive officers of industrial corporations, members of university faculties and officers of some of the federal agencies.

The conference is sponsored by engineering alumni associations of nine universities, the American Society of Mechanical Engineers, the American Institute of Chemical Engineers, and the American Association for Adult Education. Included in the addresses will be "An Analysis of the Railroad Situation" by Professor William J. Cunningham of the Harvard University School of Business Administration; "Labor Under the NRA Codes" by Professor Carroll R. Daugherty, of the University of Pittsburgh; "Industry Planning under NRA" by Leon B. Lent, executive officer of the code authority, scientific apparatus industry; "Paper Money and Gold in International Trade" by James D. Mooney, president of the General Motors Export Co., and "Trade in a Changing World" by James A. Farrell, former president, United States Steel Corporation.

Metal-Working Code Hearings Scheduled

Date	Place	Deputy Administrator	Association
July 20	Commerce Building	J. G. Cowling	American Washing Machine Manufacturers (Cost Principles)
July 23	Washington Hotel	J. G. Cowling	Radio Manufacturers (Application for exemption)
July 23	Willard Hotel	N. W. Foster	Plumbing Fixtures Manufacturers (Prices)
July 24	Commerce Bldg.	N. W. Foster	National Beverage Dispensing Equipment (Termination of Exemption)

• PATENTS •

July 3, 1934

Metal-Working Machinery

Method of and Machine for Cutting Gears. Maxwell H. Hill and Magnus H. Johanson, Rochester, N. Y., assigned to Gleason Works. Patent 1,964,799.

Method of and Machine for Cutting Gears. Maxwell H. Hill, Rochester, N. Y., assigned to Gleason Works. Patent 1,964,800.

Jig Filling Machine. Arthur J. Mason, West Hartford, and William L. Tanered, Hartford, Conn., assigned to the Bush Manufacturing Co. Patent 1,964,827.

Machine Tool. Leo A. Dumser and Clement J. Schroeder, Rockford, Ill., assigned to Sundstrand Machine Tool Co. Patent 1,964,937.

Apparatus and Method of Producing Gear Members. Joseph R. Richer, Chicago, Ill., assigned to Illinois Tool Works. Patent 1,965,002.

Dual Control for Shapers. William A. Walker, Torrington, Conn., assigned to the Hendey Machine Co. Patent 1,965,015.

Grinding Machine. Ralph Waldo Young, Beloit, Wis., assigned to Charles H. Besly & Co. Patent 1,965,020.

Machine Tool. Walter D. Archea, Norwood, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,965,210.

Backlash Eliminator. Max de Haas, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,965,221.

Vibration Dampener for Machine Tools. Hans Ernst and Mario E. Martellotti, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,965,224.

Grinding Machine. Frederick S. Haas, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,965,234-1,965,235.

Milling Machine. Lester F. Nenninger, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,965,252.

Variable Speed Transmission for Machine Tools. Lester F. Nenninger, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co Patent 1,965,253.

Milling Machine. Millard Romaine and Walter D. Archea, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,965,259.

Grinding Machine. Clifford L. Schulte, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,965,261.

Welding Machine. William H. Gibb, Bay City, Mich., assigned to Thomson-Gibb Electric Welding Co. Patent 1,965,312.

Method of and Apparatus for Electric Welding. George A. Cutter, Dedham, Mass., assigned to Thomson-Gibb Electric Welding Co. Patent 1,965,521.

Indexing Mechanism (Gear Grinder). Richard John Bullows, Handsworth, Birmingham, England assigned to the Gear Grinding Co., Ltd., Handsworth Birmingham, England. Patent 1,965,541.

Tools and Attachments

Stripping Mechanism. John M. Glasson, Johnstown, Pa. Patent 1,964,910.

Method of Making Cutting Tools. Henry Martin Stanley Binns, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,964,972.

Processes

Machine for Cutting Screw Threads. Hermann Godziewski, Eichwalde, near Teltow, Germany. Patent 1,965,035.

Art of Grinding. Willetts Peaslee, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,965,256.

July 10, 1934

Metal-Working Machinery

Grinding Machine. Walter Ferris, Milwaukee, Wis., and John Ferris, Fountain City, Tenn., assigned to the Oilgear Co. Patent 1,965,696.

Automatic Boring and Facing Machine. William Sinclair, Detroit, Mich., assigned to Production Engineering Co. Patent 1,965,714.

Hack Saw Machine. Charles Fletcher, Cheadle Hulme, England. Patent 1,965,743.

Automatic Feed for Machine Tools and the Like. Harry F. Vickers, Los Angeles, Calif. Patent 1,965,867.

Suppo t for Elevating Device for Machine Tools. John M Rusnak, West Hartford, Conn., assigned to Pratt & Whitney Co. Patent 1,966,021.

Milling Machine Table Transmission and Control Mechanism. Joseph B. Armitage, Wauwatosa, Wis., assigned to Kearney & Trecker Corp. Patent 1,966,158.

Method of and Apparatus for Lapping Gears. Herman Jackowski, Remacheid, Germany. Assigned to W. Ferd. Klingelnberg Sohne. Patent 1,966,172.

Automatic Tapping Machine. Herbert S. Eades, Pottstown, Pa., assigned to Pottstown Machine Co. Patent 1,966,337.

• BUSINESS ITEMS •

The V. E. Sprouse Company of Indianapolis plans to erect a factory building at Columbus, Ind., and move its entire production plant to that city. The company manufactures metal products of various sorts and the factory building is to be completed in ninety days. The company has had an experimental branch in Columbus for some time and will consolidate experimental and production branches.

The Probon Corp. of Delaware, which bid in the assets and business of the New Process Gear Co. Inc., of Syracuse, N. Y., at the receiver's sale June 15, will turn over the property to a new concern, the New Process Gear Corp. of Delaware. The new corporation will continue the manufacture of differential gear sets and automotive equipment.

Yankee Metal Products Co., New York, N. Y., automobile accessories, has leased manufacturing space in the plant formerly occupied at South Norwalk, Conn., by the American Hat Co.

James Reynolds Manufacturing Co., New Haven, Conn., manufacturing machine screws and similar products, had its plant damaged by fire July 5, and the loss is placed at about $20,000.

W. S. GALLAGHER, sales engineer for the Ex-Cell-O Aircraft & Tool Corp., Detroit, has opened a new sales office at 1807 Elmwood Ave., Buffalo, N. Y.

• PERSONALS •

A. B. Peterson Joins Federal Tool Corporation

A. B. Peterson, for many years chief of the division of tool and machine construction for the Hawthorne (Ill.) Works of Western Electric Co., has accepted a directorship on the board of the Federal Tool Corp., Chicago. He will take charge of the sales engineering for the tool company, and direct sales of their dies, precision tools, drop forge dies and tools for the metal working industries. Mr. Peterson, in his long connection with the Western Electric Co., has gained a wide reputation as a leader in the machine tool industry.

WILLIAM B. HENDERSON, secretary of the code authority and Washington representative of the Machinery and Allied Products Institute, will become executive vice-president of the Refrigerating Machinery Association on August 1. Offices of the association will be moved from Philadelphia to Washington.

LESLIE MCARTHUR, vice-president and general manager of the Bassick Co., Bridgeport, Conn., has resigned, and W. L. ROSE, Chicago, Ill., has been elected to succeed Mr. McArthur.

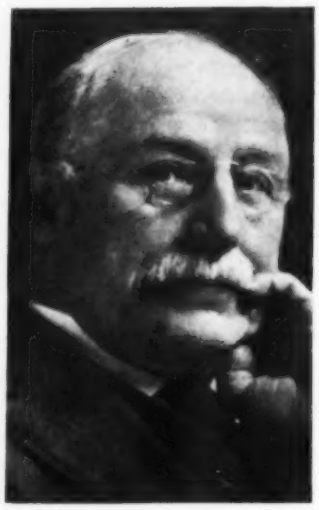
A. D. HUNT has been appointed manager of engineering at the South Philadelphia plant, Westinghouse Electric & Mfg. Co., to succeed JOHN M. LESSELLS, resigned.

EDWARD H. MUHLENBROCK was recently elected president of the Holland Furnace Co., Holland, Mich., to succeed H. W. THORNE, resigned.

FRANK GARRATT, president of Hope's Windows, metal furniture manufacturer, Jamestown, N. Y., has been appointed receiver for the Jamestown Metal Desk Co., to succeed FRANK C. RIEHL, resigned.

ALFRED J. KROENKE has been appointed general manager and director of the Geometric Stamping Co., Cleveland, Ohio.

• OBITUARIES •



Henry E. Eberhardt

Henry E. Eberhardt, 83, president and founder of the Newark Gear Cutting Machine Co., Newark, N. J., died June 30. After learning his trade, he and a brother were taken into partnership by Ezra Gould, Newark machine manufacturer, the firm being known as E. Gould & Eberhardt. While a member of that firm he invented the automatic gear cutting machine and many other mechanical devices. In 1904 Mr. Eberhardt sold his interests to Gould & Eberhardt and entered into business with his sons as Eberhardt Bros., now the Newark Gear Cutting Machine Company. Three sons, Henry J., Frank E., and U. Seth Eberhardt, are still with the company.

Llewellyn W. Jones

Llewellyn W. Jones, 72, founder and president of the Manganese Steel Forge Co., and president of the Audubon Wire Cloth Co., Philadelphia, died June 24. Mr. Jones founded the company in 1921 and to him are due in large measure the mechanical and commercial developments of rolled and forged manganese steel. His experience in the forging industry dated back to 1889 when he became president and general manager of the Philadelphia Drop Forge Company. Later he was superintendent of the Schoen Pressed Steel Company, where the first commercial pressed steel cars were manufactured. In 1912 he became works manager of the Taylor Iron & Steel Company and next vice-president in charge of manufacture of the Taylor-Wharton Iron & Steel Company. In 1914 he joined the Alloy Steel Forging Co., of Carnegie, Pa. The Manganese Steel Forge Company was formed in 1921.

E. K. Swigart

E. K. Swigart, 67, founder and chairman of the board, The Oilgear Co., died July 7 as the result of a heart attack. Mr. Swigart founded the company in 1921. He was also senior vice-president of the Bucyrus-Erie Company since 1911, and was a member of the executive committee and of the board of directors.

Edward L. Moran, former superintendent of the Baltimore & Ohio Railroad Company machine shops at Grafton, W. Va., and in later years superintendent of the company's Mt. Clare shops, Baltimore, died at his home in Baltimore on July 3. He had been ill several months.

FRANK P. CALLAHAN, who resigned in 1929 as vice-president of the Foote Bros. Gear & Machine Co., Chicago, died at the age of 55.

• MEETINGS •

FOURTH ANNUAL ECONOMIC CONFERENCE. General theme: an economic appraisal of the New Deal. Stevens Engineering Camp, Johnsonburg, N. J., August 11-19. For further information apply to the president's office, Stevens Institute of Technology, Hoboken, N. J.

SILVER BAY CONFERENCE. Seventeenth annual conference on industrial relations, August 22-25. Silver Bay on Lake George, N. Y. E. C. WORMAN, executive secretary, 347 Madison Ave., New York, N. Y.

American Machinist

REFERENCE BOOK SHEET ©

Sizes of Standard Taper Roller Bearings

Simplified Practice Recommendation R67-33, as revised by the industry and issued by the National Bureau of Standards, effective November 1, 1933.

The original list, approved in 1927, gave bearings ranging in bore size from 5/8 to 4½ in., and intended largely for automotive use. The revised recommendation extends the list and adds steep-angle bearings up to 12-in. bore for naval requirements and for general industrial and automotive uses. Conventional bearings are divided into three series, light, medium and heavy. The extended sizes in the medium series up to 11 in. and in the heavy series up to 12 in. were carefully worked out, but they are not ready yet for standardization. Recommendation as simplified practice should assist in making these bearings adaptable as a future standard for industry.

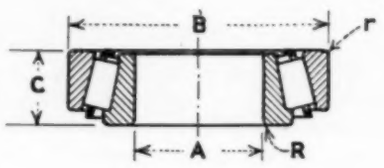


Table 1—Light Series[1]

SAE no.	A	B	C	R	r
L3	0.375	1.2595	0.394	3/64	3/64
L4	.500	1.3775	.433	3/64	3/64
L5	.625	1.625	.5625	3/64	3/64
L6	.750	1.8504	.5662	3/64	3/64
L7	.875	2.047	.591	3/64	3/64
L8	1.000	2.3125	.750	3/64	3/64
L9	1.125	2.500	.8125	3/64	3/64
L10	1.250	2.717	.7813	3/64	3/64
L11	1.375	2.844	.8125	3/64	3/64
L12	1.500	3.000	.8125	3/64	3/64
L13	1.625	3.1496	.8268	3/64	3/64
L14	1.750	3.3464	.8125	3/64	3/64
L15	1.875	3.500	.8125	3/64	3/64
L16	2.000	3.6718	.8125	3/64	3/64
L18	2.250	3.937	.8268	3/64	3/64
L20	2.500	4.3307	.8661	3/64	3/64
L22	2.750	4.6875	1.000	3/64	1/16
L24	3.000	5.000	1.0625	3/64	1/16
L26	3.250	5.375	1.1875	3/64	1/16
L28	3 500	5.625	1.1875	3/64	1/16
L30	3.750	5.875	1.250	3/64	1/16

[1] The letters at the heads of columns in this and other tables correspond with the letters used in the illustrations. All dimensions are in inches

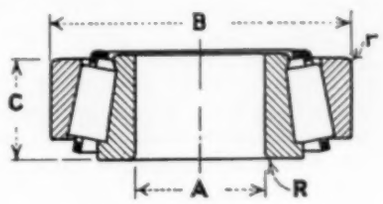


Table 2—Medium Series[1]

SAE no.	A	B	C	R	r
M6	0.750	1.938	0.7813	3/64	3/64
M7	.875	2.240	.7625	3/64	3/64
M8	1.000	2.375	.7813	3/64	3/64
M9	1.125	2.615	.9375	3/64	3/64
M10	1.250	2.750	.9375	3/64	3/64
M11	1.375	3.000	.9375	3/64	1/16
M12	1.500	3.125	1.000	3/64	1/16
M13	1.625	3.3125	1.1563	3/64	1/16
M14	1.750	3.4375	1.1875	3/64	1/16
M15	1.875	3.6718	1.1875	3/64	1/16
M16	2.000	3.875	1.1875	3/64	1/16
M18	2.250	4.125	1.1875	3/64	1/16
M20	2.500	4.4375	1.1875	3/64	1/16
M22	2.750	4.875	1.1875	3/64	1/16
M24	3.000	5.375	1.1875	3/64	1/16
M26	3.250	5.5115	1.4375	3/64	1/16
M28	3.500	6.000	1.5625	3/64	1/16
M30	3.750	6.375	1.5625	3/64	1/16
M32	4.000	6.625	1.625	3/64	1/16
M34	4.250	7.500	1.875	3/64	1/16
M36	4.500	8.125	1.875	3/64	1/16
M38	4.750	8.4375	1.9375	3/64	1/16
M40	5.000	8.500	1.875	3/64	1/16
M44	5.500	9.500	2.250	3/64	1/16
M48	6.000	10.000	2.625	3/32	1/16
M52	6.500	11.375	2.500	3/32	1/16
M56	7.000	11.375	2.500	3/32	1/16
M60	7.500	12.500	2.6875	1 3/64	1/16
M64	8.000	12.500	2.6875	1 3/64	1/16
M68	8.500	13.000	2.750	3/32	1/16
M72	9.000	14.000	2.750	1 7/64	5/16
M76	9.500	14.500	2.6875	1/4	1/16
M80	10.000	15.750	2.750	1/4	1/4
M84	10.500	16.000	2.750	1/4	1/4
M88	11.000	17.246	3.000	1/4	5/16

See footnote, table 1.

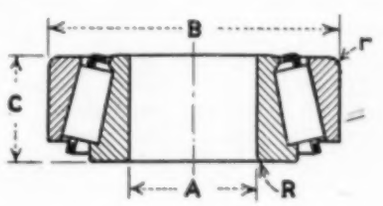


Table 3—Heavy Series[1]

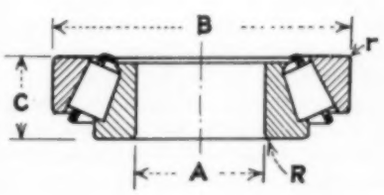
SAE no.	A	B	C	R	r
H8	1.000	2.615	0.9375	3/64	3/64
H9	1.125	2.8593	1.1875	3/64	1/16
H10	1.250	3.125	1.1563	3/64	1/16
H11	1.375	3.3125	1.1563	3/64	1/16
H12	1.500	3.4375	1.1875	3/64	1/16
H13	1.625	3 750	1.250	3/64	1/16
H14	1.750	4.000	1.375	3/64	1/16
H15	1.875	4.250	1.4375	3/64	1/16
H16	2.000	4.375	1.500	3/64	1/16
H18	2.250	4.875	1.500	3/64	1/16
H20	2.500	5.375	1.625	3/64	1/16
H22	2.750	5.909	1.750	3/64	1/16
H24	3.000	6.375	1.875	3/64	1/16
H26	3.250	6.625	1.875	3/64	1/16
H28	3.500	7.125	1.875	5/64	1/16
H30	3.750	7.500	2.250	5/64	1/16
H32	4.000	7.875	2.4375	5/64	1/16
H34	4.250	8.375	2.625	5/64	1/16
H36	4.500	9.250	2.500	1/4	1/16
H38	4.750	10.1875	3.0625	5/64	1/4
H40	5.000	10.250	3.0625	3/64	1/4
H44	5.500	11.625	3.500	3/64	1/4
H48	6.000	12.125	3.500	3/64	17/64
H52	6.500	13.500	3.500	3/64	1/4
H56	7.000	13.750	3.500	3/64	1/4
H60	7.500	14.372	3.625	1/64	1/16
H64	8.000	14.500	3 625	1/64	1/16
H68	8.500	15.750	3.500	1 3/32	1/16
H72	9.000	15.750	3.500	1 3/32	1/16
H76	9.500	16.750	3.750	1 3/32	1/16
H80	10.000	17.250	3.750	9/64	1/4
H84	10.500	18.500	3.750	3/64	1/16
H88	11.000	18.500	3.750	3/64	1/16
H92	11.500	19.500	3.750	3/64	1/4
H96	12.000	20.500	4.250	3/64	1/4

See footnote, table 1.

Table 4—Steep Angle Taper Roller Bearings[1]

No.	A	B	C	R	r	No.	A	B	C	R	r
S6	0.750	2.125	0.875	1/16	3/32	S32	4.000	9.000	2.125	3/16	1/8
S7	.875	2.5625	.875	1/16	1/16	S36	4 500	9.875	3 000	1/8	1/4
S8	1.000	2.6875	.875	1/16	1/16	S40	5.000	12 250	3.500	1/8	1/4
S9	1.125	2.8593	.9687	1/16	1/16	S48	6.000	14.750	3 4375	1/8	1/4
S10	1.250	3.125	1.000	1/16	1/16	S56	7.000	16.875	4.1875	1/8	1/4
S12	1.500	3.4843	1.000	3/32	1/16	S64	8.000	19 000	4 625	1/8	1/4
S14	1.750	3.750	1.2187	3/64	1/32	S72	9.000	20 000	4 625	1/8	1/4
S16	2.000	4.375	1.1875	3/64	1/8	S80	10.000	21 000	4 625	1/8	1/4
S20	2.500	5.513	1.4375	3/32	3/32	S88	11 000	24 750	5.500	17/32	17/32
S24	3.000	7.000	2.1875	3/64	1/8	S96	12.000	25 500	5.500	17/32	17/32
S28	3.500	7.874	2.0772	5/16	1/8						

See footnote, table 1.



Obsolescence—A Bar to Recovery

HECTOR J. CHAMBERLAND

A SIX-MONTHS' study of general conditions in a large electrical manufacturing plant clearly indicated that at least one story connected with general recovery has not been dramatized beyond the first act. Industrialists, who should have been the first to pitch the ball into the field of modernization, have not even entered the game and have forced many of their own men to remain behind the fence. Evidently, a certain group of manufacturers has passed the buck to the average consumer with elaborate full-page magazine and newspaper advertisements, plus attractive inducements to buy.

Proof of this statement lies in the fact that the demand for motors up to ¼ hp. is so great that orders are 30 to 60 days overdue, requiring small motor departments to operate two and three shifts. While production of motors from ½ to 1 hp. may be termed fair, the call for heavier types, which would be used to motorize modern equipment, is far from being encouraging.

Why Not the Shop, Too?

The present outlook demonstrates that makers of household appliances have confidence that the wage earner will manage somehow, from his miserly pay check, to spare some loose change towards the price of a refrigerator, washing machine or vacuum cleaner. Of course, it is logical to educate housewives to modernize their homes, but suppose they were told also that 50 to 75 per cent of the machine tools used to build these products are the same that turned out machine guns, rifles and other ammunition from 1915 to 1918. Such an announcement would probably change the attitude of the buying public over night.

The demand for better finishes and closer limits is gradually increasing; in spite of this, workmen are expected to hold limits of 0.002 and 0.003 in. with equipment that is not fit even for roughing operations. On the average, wages have not advanced to compensate for more than 15 per cent of the loss of working hours. Because of stiffer inspection requirements, the operator is compelled to slow up his output and the difference between the new and former rate is automatically taken away from him. As the time of varied operations had been set and reset to obtain maximum production at minimum cost, it is impossible, even for the highly skilled mechanic, to deliver both 1934 precision and 1928 production with 1918 equipment.

National labor unrest is not caused entirely by the wage question by any means. To a great extent, the dissatisfaction is the outcome of bad conditions under which the employee earns his money. With some of the machine tools now in use, the operators start the day all fagged out from staying awake nights; they never know what happened the previous day or what's going to happen the next. Working conditions have much to do in keeping a man physically and mentally fit to perform his duties. Once his temperament is affected by being unable to control his production through obsolete machinery and tools, he is easily led to believe that conditions are much worse than they really are. Obsolescence cannot go on forever, as it is detrimental to all concerned. Modern equipment means an efficient product, representing engineering developments that build up manpower rather than destroy it.

Defects Get By

Judging from an enormous display of defective work that a large plant brought to the attention of every workman, individually, it may be assumed that a considerable amount of less defective parts escape final inspection and will call for a showdown sooner or later. Many manufacturers are not satisfied in having all phases of machining and assembling on a high production basis but extend this policy to their inspection departments. The fact that an attempt is made to produce interchangeable parts with machine tools that are ready to fall to pieces would seem the final risk. Inspectors who are working under a piecerate system of any kind are likely to take chances at the expense of the consumer. Minor defects may slide by the different operating channels and find their way into the finished product, just because someone wished to make a little extra time.

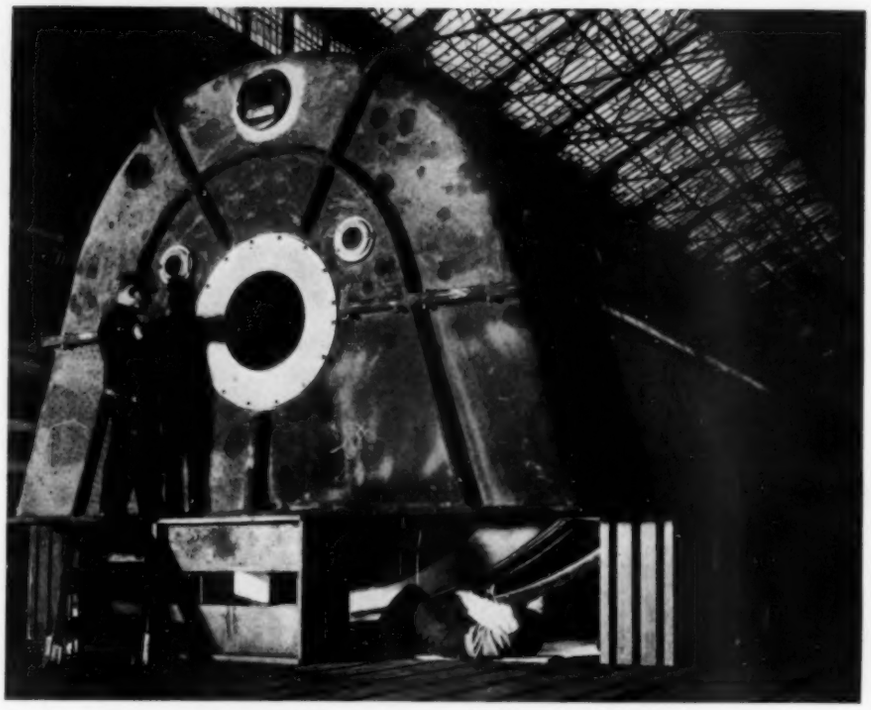
The most battered-up equipment in large plants today seems to be grinding machinery, with automatics and punch presses running close seconds. Grinding machines should be the first to be replaced for they govern the entire situation. In some machine tools possibilities for error are of less importance, but there should be no guess work connected with precision grinding operations. Mechanics cannot do the impossible, and when grinding equipment has gone so far down-grade that it will not hold size and concentricity, production must suffer somehow. If quantity is hoped for, quality must pay.

Haywire Maintenance

It is a farce to note the contraptions that decorate some grinders that are intended for precision work—worn ratchet wheels and feeding mechanisms that are coaxed to operate with elastic bands and coil springs, belts weighed down with a small junk yard to give them driving power. If a machine positively refuses to operate, it is immediately replaced by a similar one taken from another department that is not quite so busy; the latter may go on another two or three weeks while the former is being patched up instead of being sunk outside of the three-mile limit. A new spindle, gear or tailstock on an obsolete machine is not a step towards industrial prosperity.

Thousands of craftsmen are now engaged in occupations that require little experience or none at all, just because the majority of industrialists have failed to modernize as they were expected to. If a sound modernization program were to assume full swing, machinery and tool plants would also resume activity, a vast army of workmen would be called back to their former jobs, commanding much higher pay envelopes, the only solid step towards increased purchasing power.

Industrial peace cannot and will not be restored while obsolescence is in power; labor is determined not to pay



***Giant Stator*—Fabricated of welded steel plate and cast iron end bells the stator frame for the world's most powerful single-shaft generating set will weigh 215 tons. This 183,333-kv.-a. set is being built by Westinghouse for the Richmond generating plant of the Philadelphia Electric Co.**

from its own pocket for losses resulting from inefficiency on the part of capital. Modern equipment alone can lead to uniform production, to which can be welded quantity and quality that will meet present-day competitive conditions. To delay buying any longer is simply keeping the elephant's foot on prosperity. Machine tools available today are so far ahead of the times in design, that it is doubtful if five years hence we will call a 1933 machine even fifteen per cent obsolete from the point of view of complete efficiency.

Up to the Large Plants

If manufacturing plants, with working forces of 25,000 to 30,000 employees and going strong financially, are not going to loosen up soon, when can we expect the small operator to do his share? Exclusive of the automotive industry, industrialists have utterly failed to support general recovery—first, by not modernizing to any extent; second, by taxing the workmen's energy far beyond normal so that profits could not be effected for the time being. Keen competition has forced automobile manufacturers to modernize and the same competition will soon force other lines to do likewise. Profits derived with antique production facilities are fast dwindling, as profits must be planned for and not merely hoped for. There's only one alternative and that is to fall in line with broad-minded executives who well understand that a product to be entirely modern must be made on up-to-date equipment.

Why a Time Study?

P. KORNAU

Having been employed in a time study department of a large manufacturing concern I had the opportunity to observe the uses that were made of time studies, once they had been taken. The procedure was like this: Whenever a new job came through any department, the time study engineer was notified and one of his assistants was sent out with a special board equipped with stop watch and observation sheet. Then began the tedious job of writing down and timing each step of the most simple and natural operations performed by the man operating the machine.

After this was done, the total time was added up and enough added to it to make it interesting for the operator to make a little extra premium. The time study sheets were then carefully filed away and never looked at again.

Why is all this necessary? If a request is made to ascertain how long it takes to do a certain job, why not just take a watch and time the operator on a few pieces instead of writing down each and every hand movement? The result will be just as accurate. Time study taken on one man can hardly apply to another. One man may be naturally slower with his left hand, or he may be considerably quicker, but it should average up.

New Way to Make Large High-Pressure Hollow Steel Drums

E. F. CONE

From abroad comes the suggestion of a new way to make high pressure hollow drums or boiler shells. At present these are made by two processes—by hollow forging or by welding.

Very large hollow drums are being made as forgings for use in the oil industry for oil cracking, or for boiler shells in large modern high pressure steam boiler plants. Such drums are forged by a long and complicated process from a solid ingot of steel. When properly made, it is claimed that they are solid from one end to the other, free from seams or cracks of any kind and, with a wall thickness up to 6½ in., of greater thickness than can be made by any other method.

By the welding method, drums of this nature have been produced, in the last two or three years, by bending plates up to a maximum of 4 in. thick and welding them together by either the arc or gas welding process. These are claimed to be equally as good and safe as the forged product with the metal in the welded section as strong or stronger than the parent metal or metal of the plate.

The comparatively new development or process in this field is said to originate in Germany. It consists in forging the main cylindrical body of the drum from a solid ingot and then welding on to each end the dished or concave heads or ends in which are the manholes. Thus an even heavier wall thickness is possible, for this is largely governed by the size of ingot which can be made in the case of the completely forged drum.

In this connection it is interesting to note that pressure vessels for operating at low temperatures are being made of 3 per cent nickel steel plates, bent and welded by standard processes. Certain vesesls for use at from minus 50 deg. to minus 70 deg. Fahr. for dewaxing oil in the oil industry, and also at about minus 110 deg. Fahr. in the refrigerating industry, and at as low as minus 300 deg. Fahr. in the production of rare gases, are made of plain carbon steels and lately of certain alloy steels.

NEW BOOKS

★ ★ ★

BUILDING AN ENGINEERING CAREER. *By Clement C. Williams, Dean, College of Engineering, State University of Iowa. 241 pages, 5½x8 in., illustrated with halftones and diagrams. Bound in cloth boards. Published by McGraw-Hill Book Company, Inc., New York and London. Price $2.*

Written to provide a text for use in "orientation" courses this little volume gives an excellent picture of the opportunities ahead of the student engineer. The statement defining the profession of engineering and the chapter on how to study are both good. The main text is divided into chapters on materials and structures, machines and manufactures, heat energy, electrical energy, transportation and communication, after which come chapters on notable achievements in the various major branches of engineering. Inspiring enough at the moment, these latter chapters are going to have to be revised frequently if they are not to become ancient history.

Each chapter is followed by several more or less simple arithmetic problems the purpose of which is not clear. An index concludes the volume.

★

THE CHEMICAL FORMULARY. *Edited by H. Bennett. 595 pages, 5½x9 in. Published by The Chemical Formulary Co., Brooklyn, N. Y. Price $6.00.*

This volume contains such a collection of practical formulas as to make it of great value in a variety of industries. It includes abrasives, adhesives, alloys, etching, explosives, fire proofing, fluxes, solders and welding, insulation, metals, plastics, plating, resins, rust preventing, waterproofing and a host of other subjects. Polishes and abrasives, for example, cover 16 pages and include polishes for automobiles and aluminum, emulsions, floor wax, stropping compounds and the like. Adhesives for all sorts of substances are given. Solders and fluxes include aluminum, stainless steel and welding rods. Plating receives attention in 16 pages which covers methods as well as formulas for solutions for different plating baths. The contents is so varied that nothing but an examination can give an adequate idea as to its value to each trade or individual. The board of editors includes authorities from over 50 firms and the list of references consulted numbers nearly 100. Over 40 pages of index indicate that needed information can be readily found.

THE ENGINEERS' SKETCH-BOOK. *By Thomas Walter Barber. 355 pages, 5½x8½ in. Published by E. & F. N. Spon, Ltd., London. The Engineers Book Shop, 227 Park Ave., New York. Price $4.50.*

This is the sixth edition of the volume that has long been a reference book for engineers all over the world. It contains nearly 3,000 illustrations of mechanical movements, devices and appliances for the many branches of engineering. It is classified and arranged for ready reference for engineers in different lines so that the information can be easily found. Among the subjects treated are anchorages, adjusting devices, belt problems, brakes, boilers, bed plates, cams and tappets, cranks and eccentrics, crushing devices, clutches and couplings, cranes, circular and reciprocating motions, cutting tools, chucks and gripping devices, differential gears and so on through the list of mechanical devices of use to the engineer. Outline drawings show the devices and enable the engineer to select those that best meet his requirements.

Angelo Over the Toolroom

CHARLES WESLOW

I remember a story told to our class in fine arts by a French teacher 'way back in 1899 about how the famous sculptor, Michael Angelo, carved a statue out of a chunk of marble. He imagined he saw the statue in the block of stone and then proceeded to cut all the material away from what he imagined. The same idea was used in making the broach described here.

The shank and body of this tool are ⅛ in. in diameter, the length 2¼ in., and there are 13 pairs of teeth taking up 1⅞ in. of the length. The first pair of teeth were 0.002 in. away from the body, and each succeeding pair protruded 0.0025 in. further until the last pair measured close to ⅞ in. across.

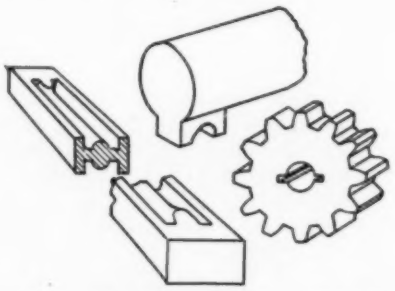
In using the tool, the shank is held in a foot-press holder while the metal piece to be broached is located in a nest on a die shoe. This particular broach was used to cut a double keyway in the ⅛-in. hole of a small gear and was made of oil-hardening steel.

Experienced toolmakers know how inaccurate certain small tools become as soon as a file (the enemy) gets its scratchers on the job. An accurate small broach can be made only by the use of a fly tool in a miller, preferably a bench miller.

Making the fly tool that makes the broach isn't so easy if you don't know how to make the broach with it. The main secret lies in using large enough stock to mill with the fly tool. In this case the stock was ⅞ by ¼ in. and 1 in. longer than the finished broach. It was milled on centers. From the cross-section shown and the Michael Angelo image thereon the method may be readily understood. The fly tool is made so that it cuts a smooth surface, making a file unnecessary for finishing. After the broach is machined with the fly cutter, all the surplus stock is milled away and then the teeth are cut.

Hardening is as important as milling. To harden a piece of this kind always heat it inside an iron pipe. When hot enough, carry the hot pipe with the piece inside of it to a point directly over the oil, holding the pipe with tongs and the piece on a wire. Then let her sink. Be sure the pipe has been heated first and coated with a dose of cyanide which causes the oil to adhere quickly to the piece when it is ducked into the oil. You can rest assured that the broach or other small piece will come out straight.

The fly tool used to make this broach was made on the end of a piece of ½-in. drill rod, one end of which is held in a spring collet in the bench miller. I take it for granted that any toolmaker knows how to do that kind of a job but as a precaution I advise the use of a small spring toolholder on which is soldered the forming fly tool. This should be turned off center when the single tooth is cut into it to insure proper clearance in operation.



Above—Stock for the broach, the fly cutter which machined it, and the gear that was to be broached

Left—Cut from a solid bar of tool steel, the broach is ⅛ in. in diameter and 2¼ in. long

THE ROUND TABLE

Hourly Pay vs. Piece Work

"Howdy, stockholder," said Al, cheerfully, from behind his plain oak desk in the tiny office of his compressor shop. "Have a chair and tell the management what ought to be done to build bigger and better compressors—and dividends."

"Quit your kidding, Al," replied Ed, gruffly, as he subsided into the only chair in sight. "This stockholder isn't telling the management how to run the business, as long as the dividends roll in. What's that?"

"Nothing. I just murmured that stockholders are all alike. Go on."

"Well, as I was saying, I want to ask you a question, but it takes a little introduction."

"Pleased to meet you," said Al, politely.

"Aw, how can anybody talk seriously to you when you act that way?"

"All right, all right. Let's get down to it."

"Williams has just come back from Detroit, Al, and he tells me that the big auto shops are abandoning piece work and paying on a straight hourly basis. What have you in mind when you get big enough for piece work—or have you?"

"I'm not quite sure, Ed. Depends a lot on how much the shop grows, just what we make, and the kind of men I can get."

"I don't just get those three if's Al."

"Well, Ed, here's my notion. As long as we build in small lots that vary somewhat, I've got to have men skilled enough to handle the variations without my standing over them all the time. With these variations it's very hard to set piece rates that mean much."

"But don't your costs vary a lot that way?"

"No more than is warranted by the differences in the product—and the human variations—if you get what I mean."

" 'Splain yourself, Al—what human variations?"

"We all have 'em, Ed. Cold pancakes for breakfast—alarm clock going off too early—neighbor's dog barks all night. A lot of things affect a man's output—'specially a hot, humid day. And they affect pieceworkers just the same."

"But you at least know what the pieces cost even if the output is lower."

"Wrong again, Ed. You may know what the *labor* cost is. But if the output is down the overhead goes up, shipments may be delayed, and a lot of things may happen."

"Then you don't believe in piece work, Al? I thought you favored it."

"I've come to believe that no one method is best for all shops, Ed. The auto shops, which started this argument, are all on progressive production operations. The speed of the machines and conveyors set the pace which must be that of the slowest man in the group."

"But shouldn't a fast man get more than the slow one, Al?"

"Making complete units, yes. Where he performs only one operation it does no good. Why drill holes faster than they can be tapped?"

"Then you don't believe in bonuses either, I judge, Al."

"There may be places for individual bonuses just as for straight piece work. Group bonus is another matter. But that's another story. And after all, Ed, management means deciding which is best for your particular plant."

Which should Al choose, hourly rates, piece work or bonus? Does the size of his shop make any difference?

Discussion

Propaganda Plates

Propaganda against mechanical equipment and the dangers of the mechanical age to society is sheer nonsense. Any worker with an ounce of gray matter knows that he owes his living, his home and transportation conveniences to the mechanical age. He knows further that in every machine built there is employment provided for engineers, draftsmen, foundry workers, screw machine product employees, for office help and salesmen to sell it. These and others make their living directly from machine tools and mechanical equipment, and must continue to do so in all probability.

There isn't an intelligent worker living who would want to go back to the tin bathtub, to the horse and buggy or to the absurd things tolerated in the dull days of the 'nineties. No worker would resent any needed education along these lines if the information is conveyed in an interesting graphic manner.

It would be well to herd the social reactionaries into their own realm and let the manufacturers of mechanical

tools and equipment continue on their progressive march of development for human needs and conveniences.

—THOMAS MURRAY,
Murray Machine Tool Company.

Within Reason?

Precedent and habit are hard to overcome. When efficiency demonstrates that it is more economical to have a machine operator attend to his machine alone and to have other work, such as grinding tools, to be done by others, his first tendency is to think he is being handicapped by the loss of an important function. However, in a highly specialized shop, the addition of such a duty would cause dissatisfaction, regardless as to whether it was beneath or above the man's regular work. The phrase "within reason," therefore, implies a certain amount of compliance with past practice and experience.

How much loyalty and effort is expected of a man? If he tries to give 110 per cent and the boss expects but 90 per cent, the situation is ideal but rare, showing unusual leadership. Too frequently the figures are reversed, which may be the cause or the result of distrust. This lies largely with the boss, as it requires some leadership, either good or bad, to form an opinion in a group of men. HARRISON G. BROWN,
Supervisor of Standards,
Crompton & Knowles Loom Works.

NRA and the Small Shop

Under the title "The Small Company Speaks for Itself," The American Iron & Steel Institute has prepared a circular containing letters from companies in support of the steel code. Among the "small" companies whose letters are printed are John A. Roeblings' Sons Company, Vanadium Alloys Steel Company, and sixteen others, each of which has a rating of over a million dollars.

It merely raises the question: Could not the Iron & Steel Institute find enough really small companies who favored the code to make a showing?

—A. W. FORBES,
Forbes & Myers.

Works Councils and Unions

"Looks like he's either scared of labor or getting soft." In this quotation from Al and Ed's discussion there lies the source of much of the industrial unrest prevalent today—fear. Fear that any move toward a better understanding should be misconstrued as a sign of weakness has kept and is keeping employer and employed from cooperating to the fullest extent so that their mutual interest might be served.

In this matter of works council or union, NRA has laid down no hard and fast rule. Compulsion is absent, and the employee is at liberty to choose. Naturally he is going to choose the type of representation which gives most for least; if the works council is going to do more for him than the outside union he isn't going to pay union dues—even should a certain amount of company dominance prevail. If, however, the works council is a council in name only and no attempt is made to better conditions, then the works council will be ignored in favor of the union.

Like Ed, I believe the works council can be made attractive; indeed it must be made attractive if the loyalty of the employees is to be won; and I favor the Chrysler type of set-up whereby a secret ballot is cast to elect representatives.

If fear can be superseded by confidence, the barriers to industrial harmony must inevitably be swept aside.

—ROBERT S. ALEXANDER.

Subsidized Suggestions

In acting upon suggestions it is imperative that a policy be inaugurated whereby the employee suggesting an accepted improvement will receive a definite percentage of the savings effected by it over a period of one year. It is especially important that the requirements for successful award be clearly and carefully defined beforehand, as this proviso may be instrumental in reducing

to a minimum any expression of discontent among those competing.

In attempting a plan of this nature, the management must be prepared to receive hundreds of suggestions in the beginning, though after the first flurry interest will probably subside to a point where the only ideas submitted will be ones having tangible possibilities. The principle of paying for practical suggestions is fundamentally sound, but unless the matter is handled with rare discretion, it will flare up as an instigator of dissension, jealousy and those kindred difficulties that grow to such proportions as to eventually defeat the best intentions. HAROLD L. WYNN,
Executive Engineer,
Pacific Electric Manufacturing Corp.

At one time a strike was being considered by a group of our men under the sway of radical agitators. Several of our men mentioned that we had always been willing to reason, and suggested that they talk over the matter with us instead of immediately striking. We talked with them and they finally agreed to continue at work at the old scale of hours and wages. Several thousand dollars were saved in this one instance as an indirect result of our having considered suggestions.

We make a distinct effort to foster good feeling and good will between the management and the employees. Taking account of the good will and the direct and indirect good accomplished by considering suggestions, can it possible be worthwhile to discontinue the practice? WILL HERMAN,
Superintendent,
Tanenbaum Oil Company.

False Security

Expansion of credit to the working classes is not always good for them, as many have gotten into serious financial difficulties through having to thus mortgage their futures. But it does not follow that an employer is privileged to direct his employees in spending their money, and here Al is playing with fire. His intentions may be entirely benevolent, but that will not prevent his men from resenting his interference.

Even if his men did not resent the actual dictation as to what they were expected to do with their money, they would certainly resent what they fancied it implied. When an employer insists on setting up a security basis for his employees, his action smacks of an intelligent-I-and-dumb-you attitude. While such an attitude may be justified in some cases, it is quite certain that it will not be appreciated.

—JOHN E. HYLER.

Monies saved are either the result of good financial management and business acumen, or the results of self-sacrifice and a lower standard of living. The average worker is not a good manager, which is probably the reason why he is identified with the working personnel.

Any attempt on the part of an employer to control the saving propensities of his employees will result in failure. Personal habits, greed, and lack of integrity are difficult to control and govern, and until such time as selective breeding, or some alternative, has made us a nation of idealists, I would advise Al to confine his activities to keeping his products and his methods attuned to popular trends, and his corporate and his individual finances in order.

—IRA S. WILLIAMS.

• IDEAS •
FROM PRACTICAL MEN

A Combination Hand and Bench Riveter

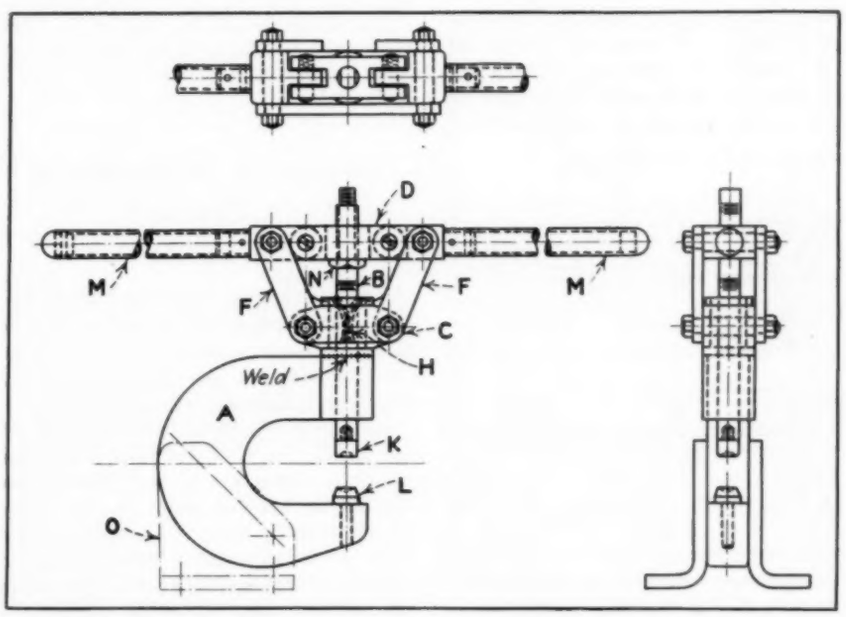
G. A. FRIES

The riveter illustrated was developed for use in fabricating aircraft members. It has a capacity for heading duralumin rivets up to $\frac{3}{8}$ in. in diameter by the application of squeezing pressure through toggle links.

Essentially, the riveter consists of the yoke *A;* the plunger *B;* the lower fulcrum block *C;* the upper fulcrum block *D;* the toggle links *F;* terminating in the gear segments *H;* the die *K;* the anvil *L;* the operating levers *M;* and the necessary bolts and screws upon which the levers and links are pivoted.

In operation, raising the levers causes the upper fulcrum block and the plunger to move downward and force the rivet against the anvil. Since the rivet bears on the anvil and can not move downward, it absorbs the pressure which results in forming the head.

The lower fulcrum block is bored for an easy fit on the turned, upper part of the yoke and is free to turn about it, so that the levers can be operated in any convenient position. The nut *N* can be adjusted on the threaded part of the plunger and acts as a stop to limit the movement of the plunger in either direction. The gear segments on the lower parts of the toggle links serve to equalize the pressure applied by the levers. By clamping the yoke in the supports *O,* the riveter can be used as a bench tool. Various sizes and shapes of rivet heads can be formed by using dies to correspond.



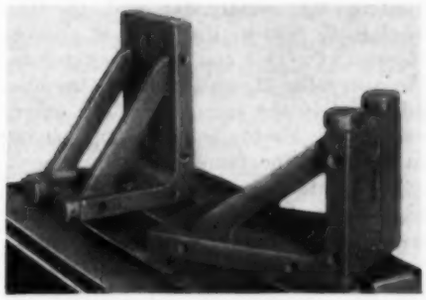
This riveter was developed for fabricating aircraft members, using duralumin rivets. It can be used either as a hand or a bench tool

Device for Locating Angle Plates

AVERY E. GRANVILLE

For locating angle plates on machine tables they are generally provided with removable tongues to fit the T-slots in the tables of the various machines on which they are to be used.

An improvement on the tongue is to provide the angle plate with disks attached by countersunk-head screws, as shown in the illustration. The disks are tool steel, hardened and then accurately ground all over. All edges of the angle plate are drilled and tapped so that the disks can be attached where required. Where the T-slots in the tables of the various machines on which the angle



Disks are used instead of a tongue, and the angle plate can be set either parallel with or at a right angle to the travel of the machine table

plate is to be located vary in width, sets of disks are made to suit. Flats on the edges of the disks permit them to be turned so as to bring the flats flush with the surface of the angle plate. With the disks so turned, the angle plate can be used on tables or plates having no T-slots.

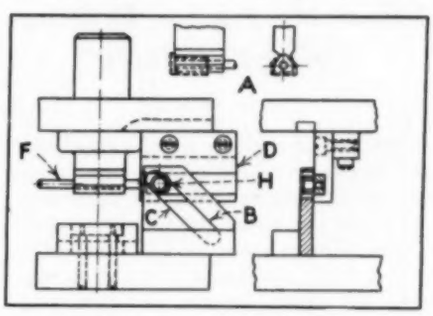
By providing means for attaching the disks to all edges, the angle plate can be set either on its side or on its end and parallel with or at a right angle to the travel of the machine table. Instead of placing the disks in a T-slot, they can be butted against the edge of the machine table. Holes in the edges of the disks provide means for turning them with a pin.

An Automatic Ejector

H. R. SCHMIDT

In the illustration is shown an automatic device for ejecting or stripping parts such as the one at *A* from the forming punch. Details of the forming tools have been omitted so as not to interfere with the clearness of the ejecting device.

To the bolster is attached the hardened-steel cam plate *B* having a slot *C* at an angle of 45 deg. Attached to the punch-holder is the thrust block *D*



This device, operated by the stationary cam, automatically strips the part from the forming punch as the ram ascends

housing the rectangular end of the ejector *F*, which slides in a groove therein. On this end of the ejector is the cam roller *H*, which engages the angular slot in the cam plate. The other end of the ejector is round and slides in a hole in the forming punch.

In operation, as the ram descends, the cam roller follows the cam slot and moves the ejector to the right, drawing the round part within the punch. After the part has been formed, and as the ram moves upward, the ejector moves to the left and contacts with the bent-up end of the part, pushing it off of the punch.

Welding Stellite Toolbits

ELBRIDGE KENNEDY

Short pieces of Stellite toolbits can be welded together by the following process: Fill a shallow pan (about 4½x5½x1½ in.) with foundry graphite mixed with water to the consistency of thick mud. Strike off the graphite even with the top of the pan and imbed in it, end to end, two strips of wood of the size of the toolbits to be welded. With the wood strips in place, bake the mold, as in foundry practice. If the graphite is too wet it will boil and make the mold porous. Remove the strips of wood and replace them with pieces of toolbit to be welded.

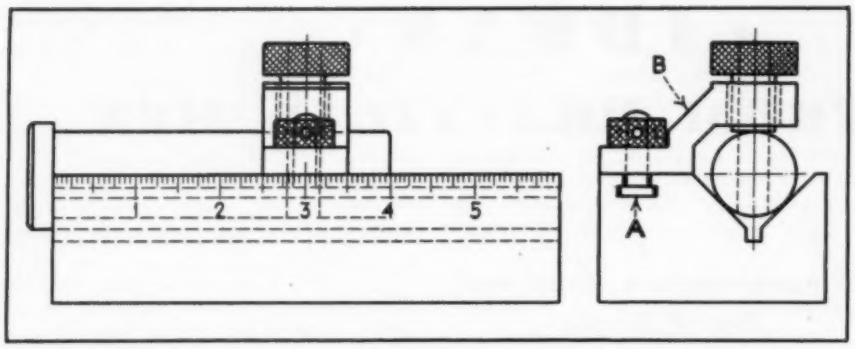
For the welding rods, use small, porous pieces of Stellite welded to a holding rod of ⅜ or ¼-in. wire or cold-rolled steel. Heat the adjoining ends of the toolbits almost to the melting point with an oxyacetylene torch, using a No. 4 tip. Both gases should be used at about 4 lb. pressure. The flame should not be too long, but it should be as hot as it is possible to get it. When the toolbits have been heated sufficiently, melt in the material from the welding rod. Success of the job depends upon the material being thoroughly fused and puddled.

Adjustable Jig for Drilling Cotter-Pin Holes

ELMER FELSKE

We had quantities of shoulder pins and screws to be drilled for cotter pins. Instead of making a jig for each size, we made the adjustable jig illustrated.

The base is made in the form of a long V-block and has a T-slot at *A* running the whole length. The bushing plate *B* slides along the base and is locked in the required position by a bolt, the head of which fits in the T-slot. Bushings of various sizes are provided and they are threaded to screw into a tapped hole in the bushing plate and hold the work down in the V-block.



Work of various sizes can be drilled for cotter pins in this jig. Besides guiding the drill, the bushing clamps the work in the V-block

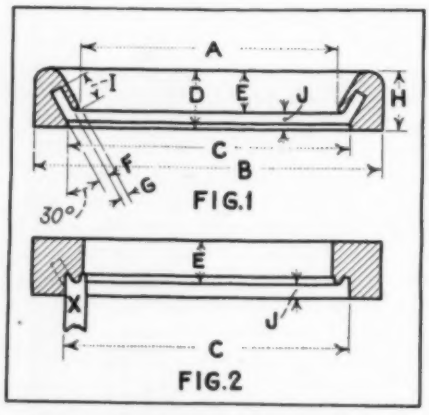
The base is graduated on one side and a zero line is scribed on the bushing plate, central with the tapped hole, so that the bushing can be centered at any required distance from either end. If two holes are to be drilled in one piece of work, two bushing plates are provided.

A Problem in Dimensions

L. KASPER

We had to machine the ring illustrated in Fig. 1, figures being given on the blueprint where letters are shown in the illustration. Also, the dimensions of the two radii were given. In so far as the dimensions of the finished ring were concerned, the blueprint covered all requirements. Nevertheless, the job presented an interesting problem in machining, as a little study will show.

Dimensions *A*, *B*, *C* and *H* could be arrived at without difficulty, but the angular groove *F* could not be placed as its position in relation to the lower face was not given and dimensions *G* could not be arrived at until groove *F* had been placed. Had the angle of groove *F* been 45 deg. instead of 30 deg., its position could easily have been found, as in that case the lower side of dimension *E*, if extended, would meet an extension of dimension *C*, intersecting groove *F* on the center line.



The author tells how he machined groove *F*, which could not be located by the dimensions given on the blueprint

The work was satisfactorily completed by first boring dimensions *A* and *C* slightly undersize. Dimension *J* was also left slightly less, so that dimension *E* would be slightly greater than required. Referring to Fig. 2, the tool *X* was made, having the required radius, the left-hand side being made at an angle of 30 deg. tangent to the radius. The tool was set so that when it was fed into the work, it would give the dimension *C*. Dimension *A* was automatically produced by the right-hand lip of the tool, which was fed into the work until dimension *J* was reached. Tool *X* was then removed and the grooving tool for the dimension *F* was placed in position to continue the angular cut started by tool *X*. After groove *F* had been cut to the depth *I*, dimension *G* was reached in the usual manner.

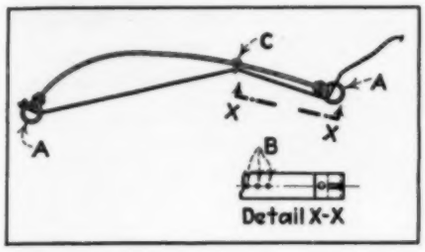
The writer would be pleased to hear from readers who may be able to suggest a better method.

Improved Draftsmen's Spline

NILS H. LOU

A spline that in many ways is cheaper and better than the usual type can easily be made from a ⅛ x 1 x 24-in. strip of xylonite or celluloid, such as draftsmen's triangles are made from.

Referring to the illustration, clips *A* are riveted to the ends and a number of ⅛-in. holes are drilled flatwise on the center line, as at *B* in the lower view. A ⅛-in. rivet *C* having a groove filed in it so that a string wrapped around it will not slip off is placed in one of the holes. A string tied to the two end clips and wrapped around the rivet, completes the device. To bend



By tightening or loosening the string and shifting the rivet from one hole to another, the spline can be bent to any desired curve

the spline to the desired curve, several trials may be necessary. Tightening or loosening the string will bend the spline to a curve of shorter or longer sweep, and shifting the rivet from one hole to another will change the location of the bend.

One advantage of a spline of this type is that it is possible to transfer a given curve from one layout to another.

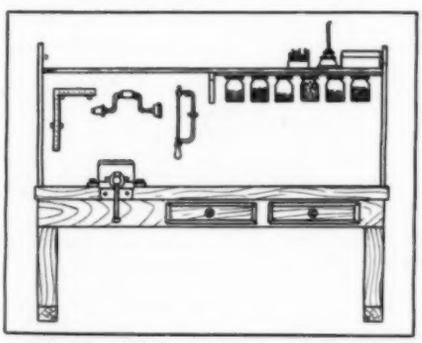
Using Preserve Jars for Small Articles

N. A. BOWERS

Many bench workers find it convenient to keep small parts such as screws, nuts, washers, etc., in preserve jars because the parts and their approximate quantity can be seen at a glance. If the jar caps are used to keep out the dust, it is necessary to use both hands to get at the contents of the jars; one hand to hold the jar and the other to unscrew the cap.

A good way to store the jars is shown in the illustration. A shelf is put up above the back of the bench and the caps are fastened to its under side with screws. When the jars are screwed into the caps, the caps support them and their contents. The contents of the jars are easily accessible, since any jar can be freed from its cap by giving it a half turn with one hand, leaving the cap attached to the shelf where it is not in the way and cannot get lost.

This scheme is in use at the Boeing School of Aviation, Oakland, Calif. It appealed to me so strongly that I made use of it on my own bench.



The jars are out of the way and the caps can not get lost because they are fastened to the under side of the shelf

An Adjustable Chucking Reamer

C. W. PUTNAM

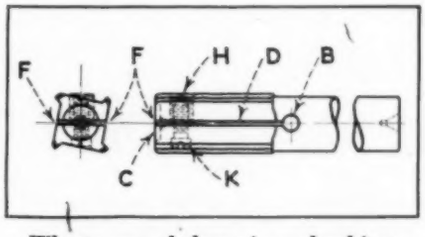
A four-fluted chucking reamer having an efficient expanding device is shown in the illustration.

In making the reamer, the hole *B* is drilled to permit flexibility and the recess *C* is counterbored in the end. The slot *D* is milled half-way through from each side, the cutter being sunk in so as to leave the small ties *F*, which are cut out after the reamer has been hardened and ground. Holes are drilled for the screws *H* and *K*, the hole for screw *H* being tapped, while the hole for screw *K* is for body clearance. Screw *H* is drilled and tapped at the end for screw *K*.

When the reamer becomes worn, it can be expanded to size by slightly backing out the screw *K* and tightening the screw *H*, until the reamer fills a ring gage of the correct diameter. After the reamer has been adjusted for size, screw *K* should be tightened.

It will be noted that if the slot *D* is milled parallel with the cutting edges of any two adjacent teeth, the reamer can be expanded so that all four teeth will cut alike. If the reamer had ten teeth instead of four there would be some teeth that would not cut efficiently, and it would be necessary to regrind the reamer after each expansion.

If the reamer should spring open after the ties *F* have been severed, it can be contracted by loosening screw *H* and tightening screw *K*. Reamers of this design can be made from 3/8 to 2 in. in diameter.



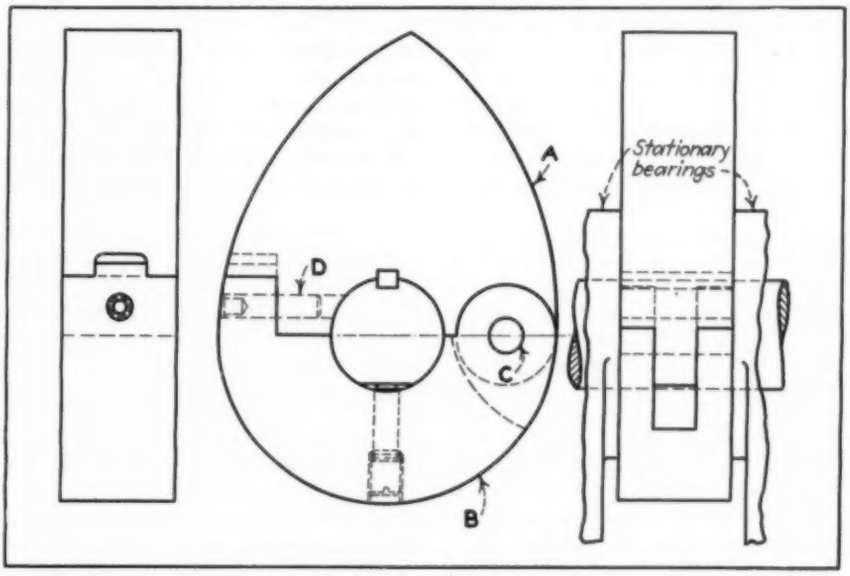
When worn below size, chucking reamers of this design can be expanded so that all four teeth will cut equally

Interchangeable Cams

J. E. FENNO

One make of wire forming machine is provided with a series of interchangeable cams for different jobs. To obviate the necessity of removing the camshaft when changing cams, the cams are split as shown in the illustration. The two parts are hinged at *A* and are locked together by the pin *B*. The pin is a slip fit in both parts and has a tapped hole in the outer end to permit its being pulled out by a screw or other threaded member.

No gaps are left at the joints of the cams to affect the continuity of movement imparted to the follower. A particular advantage is that both parts are kept together and there is no danger



Where a machine is provided with a series of interchangeable cams for different jobs, changing cams is an easy job if split cams of this type are used

of their being separated and either of them becoming misplaced when not in use. As a rule, cams of this type can be used where the space between camshaft bearings is limited, since they require no hubs for the clamping bolts.

Locating Eccentric Cranks Discussion

MATTHEW HARRIS

Referring to the article by Robert R. Mann under the title given above (*AM*—Vol. 77, page 758), I think that Mr. Mann is beginning the job at the wrong end in attempting to locate the crankpin so that the eccentric crank will be in the correct position when it is put on. If he had to replace a broken driving wheel would he bore both the hole for the axle and the hole for the crankpin, keyseat the axle hole and press on the wheel, expecting the crankpin hole to be quartering with the crankpin on the other wheel? Not on your life he wouldn't; he knows better. He would bore and keyseat the axle hole, press on the wheel, take the assembly to the quartering machine and bore the hole for the crankpin. Lacking a quartering machine, he would take the assembly to the driving-wheel lathe and use the quartering attachment to bore the crankpin hole.

If the half-hole in the crankpin is for clearance for the binding bolt, then all that is necessary is to make it large enough and cut it at a right angle to a center line through the keyway. But if the binding bolt is intended to reinforce the key, or to take the place of the key altogether, as in some engines, then it must be a snug fit in the half-hole. In either case, if Mr. Mann has no jig for drilling and reaming the half-hole, then he is simply out of luck.

Lines drawn through the centers of the axle, the crankpin and the pin in the eccentric crank form a right-angle triangle, and this triangle must be reduced to some determined proportion and be scribed on the end face of the crankpin, as in Fig. 1, where line *A-B* represents the throw of the engine crank, line *B-C* the throw of the eccentric crank, and line *A-C* the center distance between the crankpin and the pin in the eccentric crank. In scribing arcs for the points *B* and *C*, if one leg of the dividers is placed in the center hole in the crankpin, the arcs will be scribed on a plane differing from that of their common center, because the bottom of the center hole is below the end face of the crankpin, as in Fig. 2. Therefore the dividers must be opened a distance equal to the hypotenuse of each angle so formed.

Since the triangle scribed on the end face of the crankpin is necessarily reduced in size, any error will be multiplied by that reduction in the location of the eccentric crank. And errors will creep in, for surely the lengths of some of the lines will fall in decimals that can not be transferred from any ordinary scale. Then, too, the latheman may make an error in transferring the line on the wheel fit from point *B*. Whether these errors will be cumulative or whether some of them will balance others is largely a matter of luck. However, taking everything into consideration, Mr. Mann will be more than lucky if he gets the eccentric crank set within ¼ in. of its correct position by the methods he describes. If all parts of motion work are made and located with the same chance of errors, it is no wonder that we hear so many locomotives running on "three legs."

Nearly all back shops have gages for setting the eccentric cranks on locomotives of different makes and classes. When I was in charge of motion work it was my practice to enter a new crankpin about ⅛ in. into its hole, using a male center in the ram of the hydraulic press, then to put on the eccentric crank and use it as a lever to turn the crankpin until the gage showed that the eccentric crank was in its correct position; then to force the crankpin home.

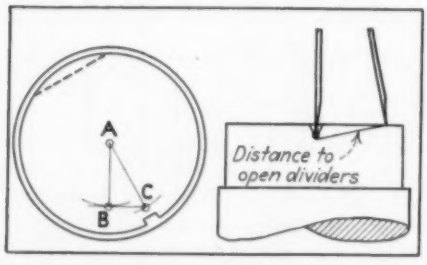
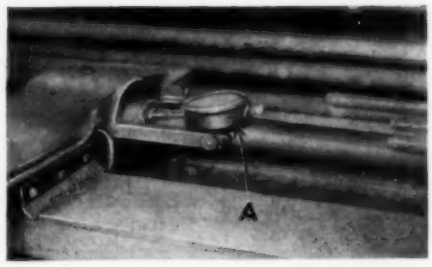


Fig. 1—Left—Triangle scribed in correct proportion on end face of crank-pin. Fig. 2—Right—Why the dividers must be opened a greater distance than the radius of the arc to be scribed

Dial Indicator Applied to a Turret Lathe

CHARLES C. TOMNEY
Chief Tool Designer, Carrier Engineering Corporation

We have some turret-lathe parts in which the depth of counterbores and the distance of shoulders from certain points must be held to very close limits. Since there is always more or less spring or "give" to contact stops, we clamped a dial indicator to a bracket attached to the end of the turret saddle on one of our turret lathes in line with the adjustable stops, as shown at *A* in the illustration.



With the dial indicator attached to the end of the turret saddle and in line with the adjustable stops, the forward movement of the turret can be closely controlled

The indicator is so set that when the turret reaches the stop position, the spindle of the indicator contacts with each of the adjustable stops in rotation. In such a set-up, the reading of the indicator is depended upon, rather than the feel of the contact of the stop on the saddle with the adjustable stops. If the runs are very short, there is no need to take the time to adjust the stops to close accuracy, as a separate indicator reading can be taken at each stop.

Centralizing Work With the Machine Spindle

CHARLES KUGLER

For many years I have been using the following method of bringing work in line with the center of the machine spindle, on both milling machines and horizontal boring mills:

With a hardened and ground plug in the taper hole in the spindle, running dead true, the bottom of the flat scriber of a height gage is brought into contact with the top of the plug. Then the scriber is lowered one-half the diameter of the plug and a line is scribed with it on the face of the column. This line is central with the spindle and is scribed deeply, as it is a permanent reference line. The point of the scriber of a

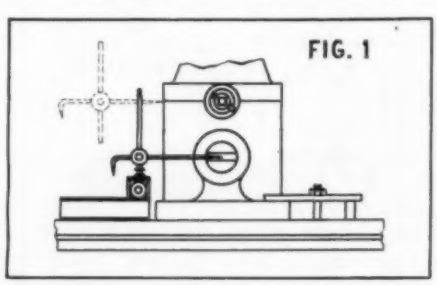


Fig. 1—The reference line on the face of the column, and central with the spindle, is located and scribed by means described in the text

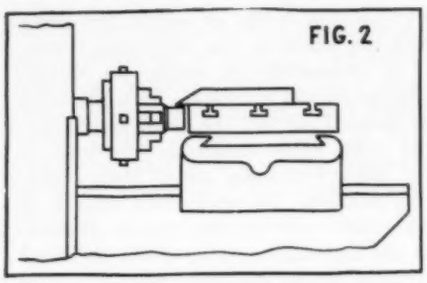


Fig. 2—Where none but ordinary tools are available, a method of locating and scribing the reference line on the face of the column is indicated

surface gage is then set to the center of the work and the knee is adjusted until the scriber point coincides with the reference line, as shown in Fig. 1. The work is then central with the spindle.

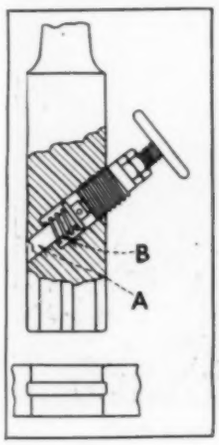
Since many shops have neither a height gage nor a hardened and ground plug to fit the spindle, the following method can be used: With the chuck on the spindle gripping a piece of steel, the steel is turned to some known diameter by a tool held in the machine vise. A flat scriber is placed on the machine table and the knee is adjusted until the bottom of the scriber touches the top of the turned piece, as shown in Fig. 2. The knee is then lowered one-half the diameter of the turned piece, reading the amount on the micrometer collar of the elevating screw. The line is scribed on the face of the column by sliding the scriber along the table.

A Grooving Tool

J. W. FRIES

We had some steel plates in which there were several hundred holes to have annular grooves cut in them, as shown in the lower part of the illustration. The device illustrated was used in a drill press and was made to fit the holes to be grooved. By slightly turning the handwheel clockwise at each revolution, the toolbit *A* is forced outward by the feed screw, cutting the grooves. The depth of the grooves is regulated by the locknuts on the feed screw. The lower end of the bar is fluted for chip clearance.

After the grooves have been cut, and before withdrawing the device from the holes, the handwheel is turned counterclockwise and the spring *B* forces the toolbit out of the grooves.



Annular grooves were quickly cut in the walls of holes in steel plates by this tool

●

SEEN AND HEARD

JOHN R. GODFREY

How Many Gadgets?

We can all enthuse over the ingenuity displayed by men who design lathes and other machines with gadgets and doodads that all but work themselves. Pushing a few buttons starts all sorts of motions and a finished piece comes out almost before we know it. But a friend who runs one of the best small shops I've ever seen, wants to know where he can get good machines minus the gadgets, which are of no use to him. A stiff spindle with a good sized hole through it, good bearings, ways rigid and true and a tool support that won't spring unduly, are all he asks. Quick changes for threads or 57 varieties of feeds mean nothing to him except unnecessary expense. He wonders whether ingenuity and desire for advertising hasn't overlooked a real market for plain machines.

Suggestion Boxes Again

Suggestion boxes were all the rage some years ago. Then some shops dropped them while others, probably only a small percentage, still find them of value. The usual experience is that a flood of suggestions are made at first. Few of them can be used for reasons which could not have been known to the suggester. The novelty wears off and suggestions are few and far between. Failure to get good results can usually be traced to the management. Some one should read every suggestion and tell the suggester why it cannot be used, as is usually the case. If it can be used later, he should be credited. Fixed rewards are unsatisfactory as some ideas are worth much more than others. Nor it is easy to arrive at a fair compensation. But in order to make suggestion boxes worth while they should be handled sympathetically and with a personal touch. Without this the system can hardly expect to secure good results.

Die Castings With Inserts

Die castings have taken another hurdle, this time in the pump field. Bearing housings are being made with steel ring inserts to take ball races for the bearings now being used. These rings can be made so close to size as to require only a finish grinding operation. They may even get them so that they can be used just as they came from the mold. They cost more than the old cast iron bearing, but machining time is now almost nil.

More Light, More Work

Illumination is always a problem in shop or office, winter or summer. Fortunately, there is a not too expensive instrument available for measuring just what the light is at any point. Average factory lighting is 5 foot-candles. One plant which has studied lighting finds that it pays to jump this light to 20 foot-candles, an increase to four times the average. The extra light has meant from 10 to 25 per cent more production, a similar reduction in spoiled work and a 40 per cent decrease in accidents. Some dividend, even with a light bill four times as large as before! It might pay to check up on light in many places.

Cast Crankshafts Save Money

Cast crankshafts can usually be made lighter than the forged shafts because metal that in no wise affects strength can be cored out. These castings, which incidentally are about 125 point carbon, are harder to machine than a normalized forging but the extra cost is much less than the saving in the material. The shafts are heated to over 1,600 F. in an electric furnace, cooled to 1,000 F. in an air blast and then reheated to 1,400 F., after which they are cooled in air. They Brinell at from 280 to 320.

New Alloys of Copper

Secret methods of hardening copper and bronze have been floating around for many moons. And some of them work. At least I have a cold chisel of some bronze or copper alloy that cuts sheet steel fairly well. Now comes a new series of alloys known as Kunial brass that can be annealed for working and hardened again at a comparatively low heat. These new alloys are credited to Dr. H. W. Brownsdon of Birmingham, England.

Germany also announces an alloy known as "Corrix" which is made of copper 86, aluminum 10, iron 4. Its main advantage is resistance to corrosion.

SHOP EQUIPMENT NEWS

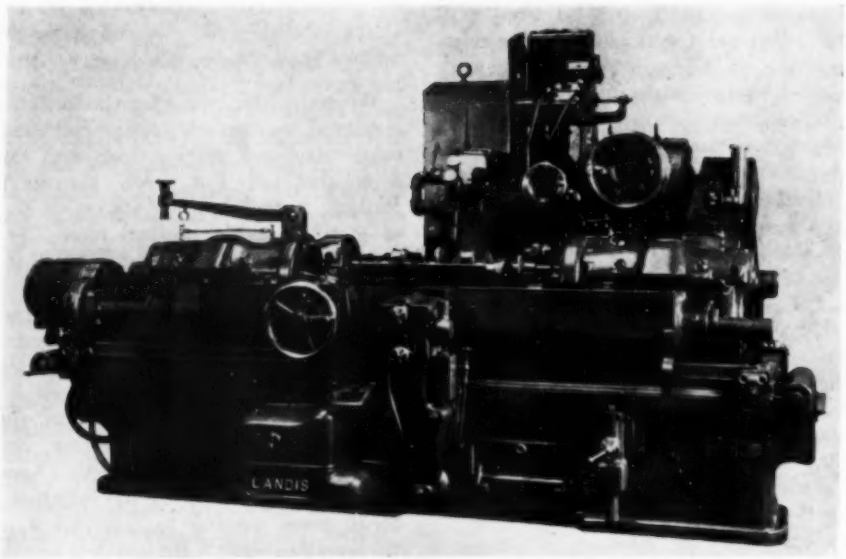
Landis 16-In. Type D Hydraulic Crankpin Grinders

Like the first crankpin grinder announced nine years ago by the Landis Tool Co., Waynesboro, Pa., the improved Type D machine combines features that make possible grinding all the pins of the crankshaft on one machine with but one handling. The advantages of this method are brought about by attaching the work rest to the front of the bed and coordinating the work-rest jaw movement with the wheel feed, the table traverse and the means provided for clamping, radial locating and longitudinal spacing. Two sizes are offered, namely 16 x 32 in., and 16 x 42 in.

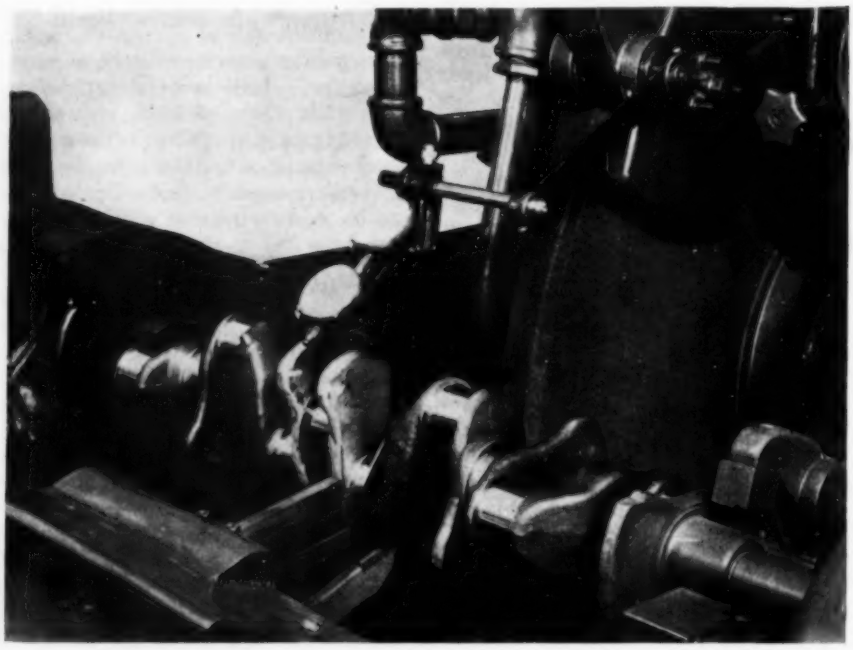
Box-type, ribbed construction is used for the bed, and the work table and wheel head guides are of such size and spacing as to give rigid support for the sliding members. Crank-head spindles and the bearings are larger than they have been heretofore. The wheel drive motor is mounted on the rear of the wheel head, and it drives the wheel spindle by means of multiple V-belts. The wheel spindle is exceptionally large and support is given by the long bearing surfaces of babbitt-lined steel bearings. The base is bridged over the work table and bolted to the bed below and in front of the grinding wheel to give greater rigidity. Throughout the machine additional weight and rigidity permit rapid stock removal without vibration and allow greater accuracy and finish.

The distance from the floor to the center line is but 36 in., to facilitate handling of heavy crankshafts. Controls are arranged so that the main control lever has a large number of functions. These functions are as follows: Clamp the work, start the work rotation, advance the work rest shoes, withdraw the work rest shoes, disengage the spacing bar plunger, traverse the work table either right or left, and release the spacing bar plunger. Another lever to the left of the main control lever is used to unclamp the work. A mechanical interlock in the main control mechanism makes it impossible when grinding to traverse the table, or when traversing with the wheel in, that is, during truing, it is impossible to rotate the heads. The heads will not rotate with the work unclamped nor will the heads rotate during work table traversal. So long as the work rest shoes are in their operative position, the work table cannot be traversed. If for any reason pressure in the hydraulic system drops, the work rotation stops automatically.

Hydraulic power is employed to traverse the work table, feed the grinding wheel, operate the work clamps and spacing bar plunger and move the work rest shoes. Work carriage guides are flood lubricated continuously with fil-



Front view of the Landis 16 x 42 in. Type D Hydraulic Crankpin Grinder. All pins are ground at one handling. Controls are centralized, and hydraulic power operates several of the mechanisms



Typical set-up for the grinding of an 8-cylinder crankshaft

tered oil. A 36-in. grinding wheel is considered standard although 42-in. wheel equipment is available. Optional equipment includes a wheel dresser built into the top of the grinding wheel fender. This dressing wheel is hydraulically driven and being permanently set-up it facilitates dressing the wheel.

Ferner Type M 60/750 Portable Brinell Tester

Materials ranging from lead to hardened steel can be tested for hardness with the portable Brinell testing outfit placed on the market by the R. Y. Ferner Co., Investment Bldg., Washington, D. C. This Type M 60/750 device is furnished with three sizes of steel balls. The designation of the instrument indicates the range in pressures in kilograms that can be used with the instrument. It consists of a tapered piece of steel 7 in. long and weighing about 34 oz., which is slit from the smaller end to within ¾ in. of the larger end. In one surface of the larger end is inserted a holder with a steel ball. In the opposite side may be inserted any of three threaded holders. One of these has a spherical top for use of the press between the jaws of a vise or in an arbor press. The second is a Morse No. 2 taper for holding the instrument in a drill press, while the third is a square, ½ in. in cross-section, for insertion in the tool post of a lathe, to

make tests of pieces while they are mounted for machining.

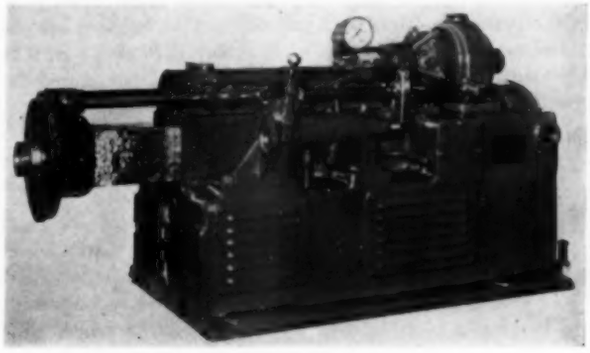
In the lower of the two prongs at the small end is mounted an adjustable screw. In the upper prong is mounted a small dial indicator graduated to hundredths of a millimeter. The adjustable screw is set against the contact plunger of the dial indicator so that the latter reads zero, and the steel ball in the opposite end is placed against the piece to be tested. Pressure is applied until the dial indicator shows by its reading the position of the adjustable screw corresponding to the pressure desired.

Barnes Square-Ram Hydraulic Drill Unit

A compact, self-contained, machine tool unit for drilling, boring, reaming, milling and similar metal-working operations has been developed by W. F. and John Barnes Co., Rockford, Ill. This unit comprises a base in which is mounted a standard electric motor and a square ram having a 12-in. stroke under control of the company's hydraulic feed cycle. Mounted in ball-bearings in the square ram is a spindle that is driven by the motor through pick-off gears. A socket is provided in the spindle-nose for driving a single cutting tool or a multiple-spindle head bolted to the flange on the end of the ram. By the use of a square section, twisting or turn of the ram is prevented.

The hydraulic feed cycle mentioned above provides rapid approach of tools to the work at an efficient rate; easy adjustment to any desired feed rate between zero and the maximum for which the cycle is designed; accurately controlled dwell if required; rapid return of tools to starting position; automatic stop, or repeat. These features are secured through the suitable combination of the following units: An adjustable volume pump that supplies oil at high-pressure for feeding tools in the work; a constant-volume pump that supplies oil in large quantities for rapid traverse; a control valve for changing movement of cutting from feed-rate to rapid traverse or the opposite; a closed hydraulic circuit from which air is entirely eliminated. These units are connected without bypasses, and thus a constant ratio is maintained between the feeding rate and the r.p.m. of the cutting tool under all operating conditions. Chatter of tools, stuttering slides and sticking valves are eliminated. Adjustable dogs operate the control valve.

Specifications: Spindle speeds through pick-off gears, with 1200-r.p.m. motor, 92 to 750 r.p.m., with 1800-r.p.m. motor, 138 to 750 r.p.m.; maximum stroke, 12 in.; capacity, any single operation or group of operations requiring 5 hp. or less; weight, including motor, for domestic shipment, 1200 lb. The base of the drill unit measures 34 in. long, 21½ in. wide and 24¼ in. high. Minimum extension of the square ram from the base to the spindle nose is 6½ in.; the maximum extension, 18½ in.



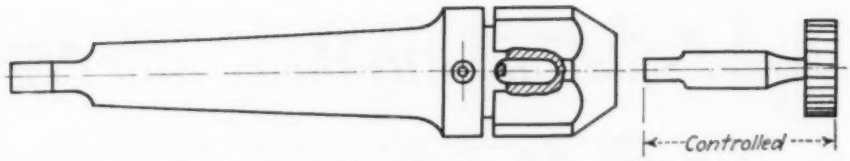
Barnes Hydraulic Drill Unit with square ram. This unit can be operated in any desired position or at any angle, can be mounted on an existing machine or easily incorporated in a new design.

Fleetweld No. 7 General-Purpose Coated Electrode

The Lincoln Electric Co., Cleveland, Ohio, is now making "Fleetweld No. 7"—a general-purpose, heavily coated electrode for welding mild steel with the shielded arc process. Fleetweld No. 7 has a high burn-off rate and low spatter loss, while the finished bead is smooth. Tensile strength ranges from 70,000 to 80,000 lb. per sq.in., the yield point from 55,000 to 60,000 lb. per sq.in., and the elongation approximately 20 per cent in 2 in. Characteristics are such that the electrode is particularly suitable for welds where setup is apt to be poor. The ⅛, 5/32 and 3/16 in. sizes are designed for welding in flat, vertical or overhead position and the 5/32, ¼, 5/16 and ⅜ in. sizes in the flat position only. The 14-in. length is furnished.

"Go-Det-Co" Toolholder and Cutter

The Goodspeed-Detroit Co., 2832 East Grand Blvd., Detroit, Mich., is now making the "Go-Det-Co" positive drive holder for Woodruff keyway cutters. In this holder there is an adjustable stop to back up the cutters, giving a range of adjustment within the holder of ¼ in., and easily adjusted to within one or two thousandths of an inch.



Left—"Go-Det-Co" Toolholder. Right—"Controlled-Length" Woodruff Keyway Cutter

Adjustment of the holder is made by means of a small hollow hexagon set-screw, moving the stop in or out as required, and then locking it in position by tightening the set-screw on the side of the holder. Another feature of this holder is that it clamps the cutter in position without changing its location. With this holder and with the positive drive, "controlled length" keyway cutters furnished by the same company, after a production job is set up with a cutter in the correct location, no further adjustments of either holder or machine table need be made when changing cutters. It is necessary only to place the new cutter in the holder against the stop, lock it in that position and proceed. The holders can be furnished with a No. 9, 10 or 11 B. & S. taper shank and with either a regular tang or draw-bar construction.

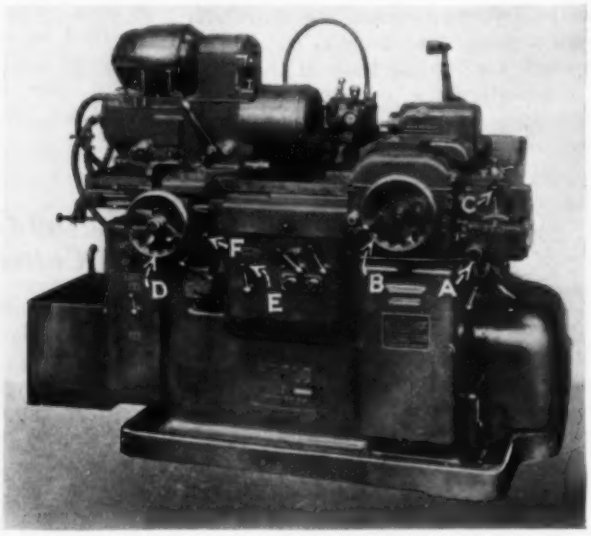
Heald No. 81 Internal Grinder—Manual and Automatic Operation

In several instances the Heald Machine Co., Worcester, Mass., has supplied its No. 81 small internal grinder arranged for manual as well as automatic operation. This machine is of the hydraulically actuated type, and the table reciprocations and the cross feed can be automatically controlled. A further feature is that when being run as an automatic, the size control can be either by the Size-Matic or Gage-Matic principles. In reality, this machine is a three-way type; that is, size control by hand plugging, from the cross-slide as in the Size-Matic or with a solid rotating plug as in the Gage-Matic.

When using this machine as a hand-operated type the knob *A* in the accompanying illustration is turned clockwise to cut off the oil under pressure to the cross-feed screw. Then the wheel slide can be moved into the work radially either by using the handwheel *B* or by moving the lever *C* to the right. Movement of the lever *C* admits oil under pressure into the mechanism to move the cross-feed screw. So long as this lever is held in the right-hand position the cross feed will continue, but as soon as the operator releases the lever the cross feed is stopped and the lever returns to the position shown. If it is desired to back off the wheel from the work, the lever *C* is turned to the left and oil under pressure will move the cross feed screw to back off the wheel. The back-off can also be accomplished by means of the handwheel *B*. The table can be reciprocated either by means of the handwheel *D* or hydraulically. In the latter case the table is reversed automatically by the usual table dogs. The handwheel *D* is especially desirable when setting up the machine for grinding.

In using the machine with the hand cross feed no means is provided for truing the wheel automatically. Thus, a lever *E* operates a valve in the control box whereby the table can be run out far enough to allow the truing device to take a pass over the wheel. As the table moves out on the extended stroke, the truing device is automatically lowered into the path of the wheel hydraulically. Upon the return of the table to bring the wheel into grinding position again, the truing device is raised clear of the wheelhead by means of a cam.

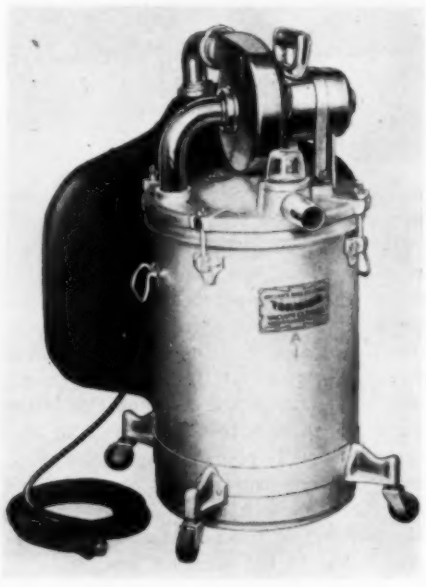
Should the operator desire to run the table out to rest position, he moves the lever *E* to the left, and the reversing dogs are lifted clear and the table moves out. With the table in rest position, the rotation of the workhead is automatically stopped. The chuck or fixture is opened hydraulically when the operator moves the lever *F* to the right.



Heald No. 81 Small Internal Grinder equipped with controls for manual as well as automatic operation

"Tornado" Model 112 Industrial Vacuum Cleaner

The Breuer Electric Mfg. Co., 852 Blackhawk St., Chicago, Ill., is building a Model 112 "Tornado" industrial vacuum cleaner with the following specifications: 1 hp. ball-bearing motor, weight, 45 lb., 12-gal. zinc-steel tank, and complete set of standard attachments for all plant cleaning purposes. A feature of this machine is the observation glass that permits the operator to see the dirt being removed when cleaning. The motor unit can be removed for use as a blower.

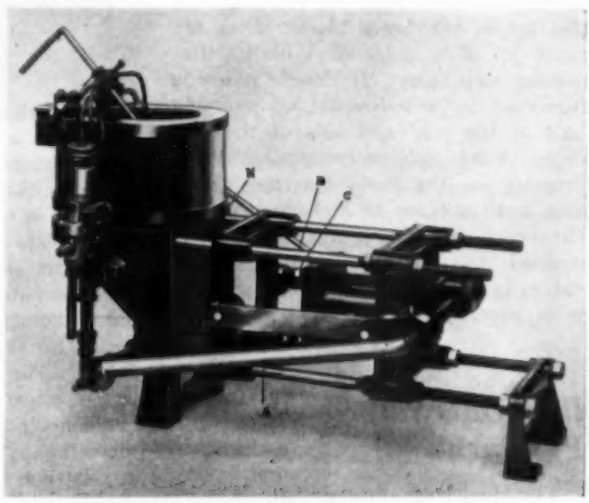


Newton-New Haven Nos. 4 and 500 Die-Casting Machines

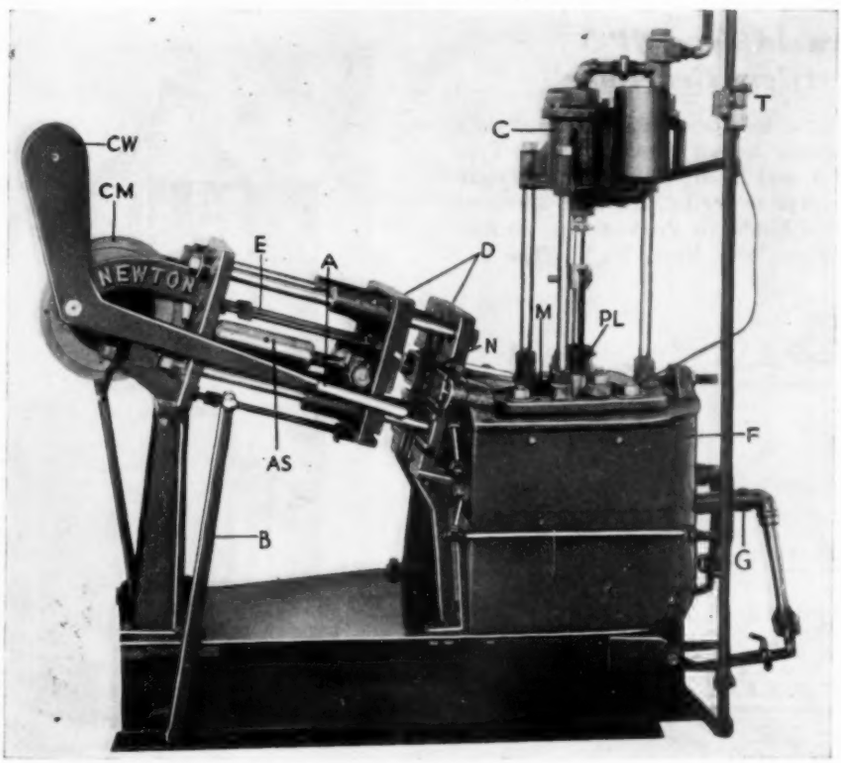
A small bench-type die casting machine has been added to the line built by the Newton-New Haven Co., New Haven, Conn. The company's largest machine has also been redesigned. The No. 4 bench-type machine will produce from 6 to 20 castings per minute in such items as knife and fork bolsters, novelties, electrical device parts, and it is also applicable where a limited number of accurate pieces are required. With the dies set up in the machine, the operator closes the dies by pushing lever *A* forward. Lever *B* is lifted, opening nozzle *N* and letting metal run into the dies. When the die is filled lever *B* is released and lever *A* is again lifted to open the dies. Dies with automatic ejection will strike the ejector bolt *B* and the castings will drop out; otherwise the operator simply flicks out the casting with a rod or wire hook. Melting pot has an atmospheric burner attached directly to a thermostat. Pot capacity is 20 lb. of metal, die capacity is 4x4 in. (4x6 in. with a dropped die), length 24 in., height 18 in.; width 12 in., and weight 50 lb. Dies can be made with hand-operated or automatic core pulls.

The No. 500 four-bar machine is a heavy-duty plunger type for pressure casting zinc and zinc alloys. The operator moves levers *A* and *B* during any casting operation; other operations are automatic. The metal is melted in the pot *M* by atmospheric gas burners *G* under thermostatic control *T*. Self-aligning dies are clamped to die bolster *D* with T-slot bolts. Dies are closed and opened by lever *A* which turns a cam *CM*. The casting operation is made by moving lever *B* to the left to operate the plunger of air cylinder *C*. This drives plunger *PL* down and forces the metal into the dies through nozzle *N*. Castings are automatically ejected when the die ejector plate strikes the bolts *E*.

Specifications: Length 8 ft. 6 in.; width, 3 ft. 7 in.; height, 5 ft. 9 in.; weight, 2,200 lb.; die capacity, 9 x 11 in. x 9 in. thick; furnace capacity, 200 lb. of metal; casting rate, 5 to 12 shots per min.

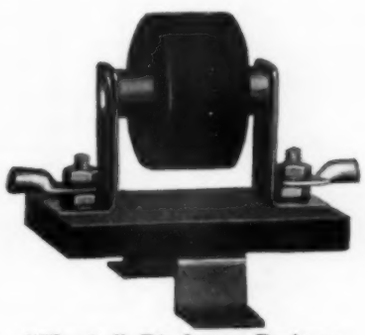


Right — Newton - New Haven No. 4 Bench-Type Die-Casting Machine that will produce 6 to 20 small castings per min. Below—Intended for pressure casting of zinc, the No. 500 machine has been redesigned; only two levers being operated by the attendant



"Thyrite" Discharge Resistors

To protect the insulation of d.c. magnetic circuits against discharge voltages when the circuits are opened, a discharge resistor acting on the same principle as the "Thyrite" lightning arrester has been introduced by the General Electric Co., Schenectady, N. Y. Such a device can be applied to protect d.c. motor fields, lifting magnets, and shunt fields of a.c. and d.c. generators. "Thyrite" is a non-porous, inorganic, ceramic material as hard as marble. It conducts about sixteen times more current each time the voltage is doubled, and easily takes care of discharge voltages and current flow. However, at line voltages it is an insulator and reduces the continuous watts loss to approximately 2 per cent of that for equiva-



"Thyrite" Discharge Resistor

lent permanently-connected fixed resistors. Designated as Type CR9196, "Thyrite" discharge resistors are available in two ratings—one for 110 to 275 volts, and the other for 500 to 650 volts.

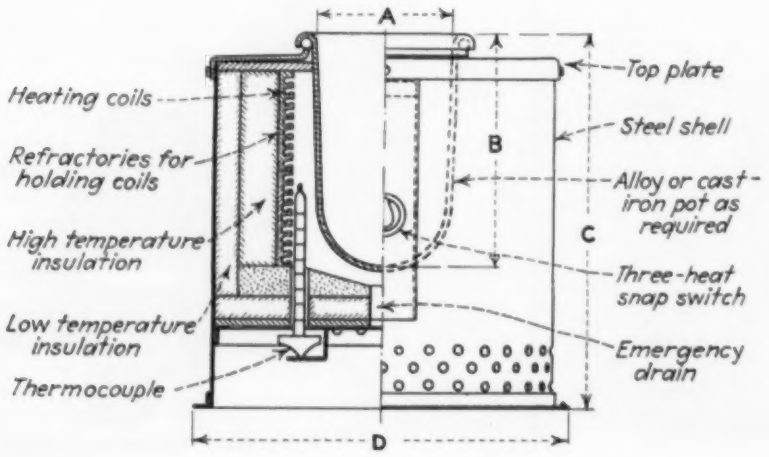
Williams, White Rod Forming Press, Straightener, and Shear

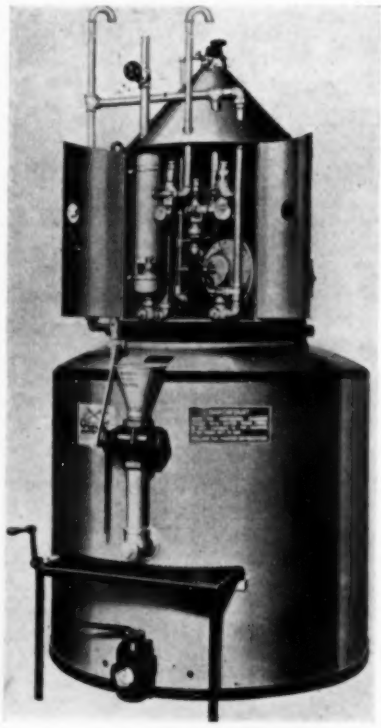
A hydraulically operated rod forming press, straightener and shear has been developed by Williams, White & Co., Moline, Ill. This machine is adapted to production bending and shearing, bending and straightening gaggers, and reclaiming bolts and tie rods. The shearing and bending dies are in the upper block, whereas the straightening dies are in the lower block. Dies are made up of a series of V-blocks that overlap each other. Hydraulic power is furnished by a self-contained pumping unit at the rear and side of the machine. Large volume is supplied at low pressure for the rapid traverse stroke, and small volume at high pressure for the working stroke. Pumps are directly coupled to a 5-hp. motor. Release valves prevent breakage of the machine from overload.

The bending and shearing dies are in the upper block and the straightening dies in the lower block. Gaggers, bolts and tie-rods can be handled.

Hevi-Duty Improved Pot Furnaces

The Hevi-Duty Electric Co., Milwaukee, Wis., is introducing an improved line of round-pot and rectangular-pot furnaces for lead, salt, babbitt and similar materials. The round-pot furnace illustrated has a top plate of ribbed, alloy cast iron fastened to the shell and insulated to prevent heat loss. Insulation consists of high and low temperature slab material. Leaks to the furnace chamber are sealed off at the top of the pot by means of a sealing rope. Heating elements of the helical-coil type are of nickel-chromium wire and are mounted in radiant refractories to reflect and radiate the heat to the pot. A three-heat snap-switch, supplied on all sizes, permits high, medium or low input. Pots are available in various metals for heat-treating or melting operations. The round-pot furnace is made in two sizes, the dimensions being 6 in. in diameter by 12 in. deep and 8 in. in diameter by 14 in. deep. The rectangular-pot furnaces are made in three sizes.



Oxweld Type MP-5 Acetylene Generator

An automatic, stationary acetylene generator known as the Oxweld Type MP-5, and rated to deliver 1,000 cu.ft. of acetylene per hr., has been anounced by the Linde Air Products Co., 30 East 42nd St., New York, N. Y. The feed is of the gravity type. Set pressure is 13 lb. per sq.in., the pressure variation within the generator being not more than ¾ lb. The carbide-charging door, the water-filling opening and the residue valve and the handhole are of large size so that time is saved in emptying, recharging and inspecting. A separate relief valve with a separate outdoor vent line is provided for the back-pressure valve. Two other relief valves with a common outdoor vent line are provided for the generator chamber. Two relief valves are used because of the high capacity of the apparatus.